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VOL. 23, NO. 1 March, 1948

THE QUARTERLY REVIEW of BIOLOGY

THE GEOGRAPHICAL DISTRIBUTION OF COLD-BLOODED VERTEBRATES

By P. J. DARLINGTON JR.

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WALLACE, Matthew, and most other persons who have done fundamental work on animal distribution have dealt primarily with warm-blooded animals, i.e., with mammals and birds. This was inevitable. Mammals and birds are the best known animals, and mammals have left an incomparable fossil record. But most of the million or so known kinds of animals are cold-blooded. If there is such a thing as a general pattern of animal distribution, it should be set by the myriads of cold-blooded forms, and mammals and birds should be special, and presumably divergent, cases.

I am an entomologist, but what I know about insects has convinced me that they, and most other invertebrates, are not yet good material for the study of zoögeography. They are in every way too little known, and their powers of dispersal are too great or too doubtful. The cold-blooded vertebrates are better known; they have left a better fossil record, although not so good a one as could be wished; and their powers of dispersal are limited and better understood. It seems to me that the cold-blooded vertebrates are therefore the best animals with which to begin study of the general pattern of animal distribution. Other animals, including insects, may add to our understanding in special cases, but their distributions are likely to be most significant when compared with the cold-blooded-vertebrate pattern.

The present paper is a survey of the geographical distribution of all existing cold-blooded vertebrates except marine fishes; that is, of fresh-water fishes, amphibians, and reptiles. It attempts to answer four questions. What is the main pattern of distribution? How has it evolved? Why has it evolved? And what does it tell us about ancient lands and climates? To find the main pattern, and to fit into it in their proper places the curious details that are so often selected and overstressed by zoögeographers, has been a matter of hard work, and has taken several years. To trace the evolution of the pattern has required additional work, and consideration of processes and clues.

SPREADING AND RECEDING OF ANIMALS

That animals are constantly evolving in some places, spreading to others, and receding from others, and thus forming new geographical patterns, is a commonplace, yet one that is not well understood. During the evolution of animals upon the earth, many faunas have succeeded each other. The succession of faunas has involved on the one hand evolution, radiation, and spreading of new dominant groups of animals, and on the other recession and extinction of most species of previously dominant groups. These two processes

are related. There is obviously a limit to the amount of life the earth can support. When an old fauna disappears and is replaced by a new one, there is probably no great change in the sum of existing life. It is therefore statistically probable that for every new species that arises an old one becomes extinct, and that for every dominant group of animals that spreads an old one disappears or is reduced to a few relicts. This proposition cannot be proved, but it can be illustrated. According to Simpson (1940a, p. 158), just before South and North America were united toward the end of the Pliocene they had about 29 and 27 families of land mammals, respectively. With two doubtful exceptions, they did not then have any families in common. After their union, the two continents exchanged mammals very extensively. In the Pleistocene they had 22 families in common, and further movements and many extinctions have occurred. After all the shuffling, South America has again 29 families of land mammals; North America, only 23. Each continent has gained certain families and lost others, but the total number of families on each is about what it was before. It seems to me no more possible to have new groups of animals constantly spreading over the world without an *approximately equal* amount of recession of old groups, than to have new generations of animals constantly being born without the death of old generations. It think, therefore, that the recession of animals is probably just about as common and important a phenomenon as spreading. It might be argued that evolution and spreading are gradual processes, which continue for long periods, and that recession and extinction are rapid and soon completed, so that at any given time most groups of animals are spreading and but few receding; yet this may not be true. If the recession of some animals is due to the spread of others, the two processes might be equally slow. I shall assume here that any group of animals at any time is as likely to be receding as spreading, and that only a study of each case can decide which process is really occurring.

The rates of spreading and receding must partly determine the age of animal distributions, which should not be confused with the geological age of the animals themselves. The fact that a group of animals is fossil in, say, the Triassic does not mean that the present distribution of the group must reflect Mesozoic geography. In the case of insects, for example, many fly well and disperse rapidly, and the pattern of their distribution may be due less to their antiquity than to the rapidity with which they spread and recede. A comparison of insects in Baltic amber with those living today shows that, between the Oligocene and the present, many groups have withdrawn from Europe to the farthest corners of the earth (Ander, 1942). A comparison of European fossil fresh-water fishes with existing fishes, over the longer time from the Eocene to the present, shows much less movement. Most fresh-water fish families perhaps date from the late Cretaceous, while many insect families are older, but the fishes probably have the older distributions. I doubt whether any existing animals have a pattern of distribution older than that of fresh-water fishes.

CLUES TO THE HISTORIES OF DISTRIBUTIONS

Before discussing the clues that are supposed to show the places of origin and directions of dispersal of groups of animals, especially of taxonomic families, the distribution of one particular family may well be given for reference. The fresh-water fish family Catostomidae, comprising the suckers and buffalo fishes, is now chiefly North American: 18 genera and 84 species are listed from North America south to Guatemala (Jordan *et al.*, 1930). Only two species of the family are known anywhere in the world outside this area. One belongs to the genus *Catostomus*. There are 20 species of this genus in America. A single one of them, ranging across northern North America from Maine to arctic Alaska, occurs also in eastern Siberia west to the Tana River. The Siberian population is only subspecifically differentiated. The other non-American species, with 3 subspecies, occurs in China. It is well differentiated, forming a genus of its own, *Myxocyprinus*. Fossil suckers are recorded from the Eocene not only in North America but also in northern China. The closest relatives of the catostomids are the cyprinids, or carps. The two families are related and distributed in such a way as to suggest that catostomids were once numerous in eastern Asia, and that cyprinids have been derived from them and have replaced them there (cf. Nichols, 1943, p. 58).

Some zoögeographers take as the place of origin of a family the place where genera and species are most numerous, and assume that outlying forms have spread away from that place. This assumption implies another, namely, that most animal groups are increasing and spreading most of the

time, and that recession and disappearance are unusual. This, as I have tried to show, is not a safe assumption. If spreading and receding are equally common, persons who take numbers of genera and species as the principal clues to places of origin and directions of spread of families are going to reach wrong conclusions about half the time. They would probably decide wrongly in the case of the Catostomidae. Of course if other evidence indicates that a given group is expanding—if, for example, the group is dominant wherever it occurs, and if it has left numerous fossils, all within the present range of the group—then the numbers of forms in different places become more significant.

Another clue to the history of families is degree of differentiation. There should be greater differences between genera and between species, and more endemism, where a family has been long established than where it has just arrived. This clue is useful, and can exactly reverse the significance of mere counting. In the Catostomidae again, the *Catostomus* in eastern Siberia is only slightly differentiated, and this, together with the fact that there are 20 species of the genus in America and but the one in Siberia, suggests movement from America to Siberia. But the single catostomid in China is generically differentiated, and in spite of counts of genera and species it is probably a relict dating from a time when catostomids were numerous in eastern Asia.

A third clue is extent of area. Some (e. g., Willis, 1922) have supposed that the area occupied by a group of organisms increases directly with the age of the group. If this were so, the place of origin of a family would be the center of its range. If it be granted that recession is as common as spreading of animals, this clue is worthless by itself, but it has some value in connection with other clues. The fact that the single *Catostomus* in Siberia occupies there a comparatively small area increases the likelihood that it has recently come from America.

A fourth, better clue is continuity of area. The Siberian *Catostomus* occupies an area which is not only smaller than but is as nearly as possible continuous with the area occupied in America, and this is consistent with its being a recent immigrant into Siberia. The Chinese *Myxocyprinus* also occupies a rather small area, but one which is isolated from America not only by Bering Strait but further by about 3,000 miles of habitable continent, and this is consistent with its being a relict of a receding group. It illustrates what may be a general principle that is not always recognized: that well differentiated forms isolated from the main range of a family *in or across areas inhabited by other, competing families* (in this case the Cyprinidae) are likely to be not immigrants but relicts persisting where the first family was once numerous. This suggests a further general principle: that if families of animals arise in certain places because of favorable conditions therein, they are likely to begin recession in the same places because of the rise of later families reacting to the same conditions. In other words, centers of evolution and dispersal are likely to be also centers of extinction. This is a corollary of the proposition that spreading and receding are related and equal processes in the animal world.

A fifth, very useful clue to family histories is the distribution of related, competing, or associated families. The distribution of the *Catostomidae* is best understood along with that of the related and competing Cyprinidae, for example.

At this point it will be well to sound a warning. Taken together, these clues are significant, but not infallible. I want to emphasize this with an example. *Esox*, the only genus of the family Esocidae, is a genus of fresh-water fishes comprising the true pikes, pickerels, and muskalonge. It has four species endemic in eastern North America, one endemic in the Amur River in northeastern Asia, and one (*E. lucius* L., the pike) occurring across North America from Labrador and New York to Alaska, and across northern Asia and Europe to the British Isles. On the basis of these facts alone, almost any zoögeographer would say that *Esox* originated in eastern North America (5 species, 4 endemic), then reached eastern Asia (2 species, 1 endemic), and finally and recently reached Europe (1 species, not endemic). The distribution of the pike is almost continuous, as if it had spread recently. Moreover, the present distribution of related families, especially of the Umbridae, is consistent with a North American origin of the whole order Haplomi to which the family Esocidae belongs. Nevertheless, there are several well preserved fossil species of *Esox* in the Oligocene and Miocene of Europe; and *Palaeoesox*, the earliest known member of the Haplomi, is in the Eocene of Europe (Berg, 1936); while neither *Esox* nor any related fish is known fossil in America. So, in spite of all contrary clues, the pike in Europe is perhaps more likely a survivor of a receding group than an immigrant from America. The reason for its

survival may be that it has unusual tolerance for cold; it is one of the few true fresh-water fishes that are widely distributed in the Arctic. This probably enabled it to cross a late Siberian-Alaskan land bridge, but it perhaps crossed from Asia to America rather than the reverse, and all American *Esox* apparently came from Eurasian stock in the first place.

The history of the Catostomidae probably involves at least two crossings of Bering land bridges, an early one from the Old World to America, and a late one back to the near part of Siberia. The history of the Esocidae also probably involves two crossings, one early and one late, but both perhaps from Eurasia to America. The present distributions of other animals that disperse more rapidly than fresh-water fishes may be products of still more complex movements. That is another reason for not trusting single clues in working out the histories of families.

Of course, there are other, special clues that help to reveal histories in special cases. For example, when a family's range includes a recently glaciated area, a movement into that area is obvious. One clue I do *not* trust is the distribution of primitive forms, which are supposed by some persons to mark the place of origin of a family, and by others, the periphery of its range. Probably they may mark either, or both.

The best clues, of course, are fossils, but the fossil record is not easy to read. Not only is the record fragmentary; it is full of misidentifications and misinterpretations which are especially troublesome in certain existing cold-blooded vertebrate groups. Even when a fossil is correctly identified, its significance may be misunderstood. Matthew, for example, knew that the fresh-water fish family Osteoglossidae, now tropical, was fossil in North America in the Eocene, and he deduced a northern origin for it, but fossil osteoglossids have recently been found in Sumatra too, probably also in the Eocene, and they cancel out the North American fossils, so far as place of origin of the family goes. I have dealt very cautiously with fossils, and have usually accepted only those that have been critically studied by specialists. Except where otherwise stated, my summaries of fossil histories follow Romer (1945).

I have tried to make it clear that, except where the fossil record is very full, the task of tracing the history of the distribution of animal groups involves clues and probabilities more than facts. A reasonable method of procedure is to work out the probabilities independently in each of a series of cases, then to put the cases together and look for a common pattern. If one is found, it will go far to confirm the probabilities in the separate cases. This is what I shall try to do for the several existing groups of cold-blooded vertebrates.

FRESH-WATER FISHES

I am greatly indebted to Dr. George S. Myers for guidance in my work on fishes, although he is not responsible for my conclusions. To understand what I shall say about fresh-water fishes, the reader should be familiar with two papers, one by Myers (1938) and one by Regan (1922).

Certain families of fishes possess an ancient physiological inability to survive in salt sea water, which binds them to the land as securely as any known animals. These strictly fresh-water groups form Myers' *primary division* of fresh-water fishes (1938). Some other families that live chiefly in fresh water sometimes enter the sea and can survive there for a limited time. These somewhat salt-tolerant groups form Myers' *secondary division* of fresh-water fishes. Many other fishes that occur in fresh water are semi-marine, or migratory, or derived from marine or migratory families. They or their recent ancestors have probably been able to pass freely through the sea. They form a *peripheral division* of fresh-water fishes (cf. Nichols, 1928). For the composition of these three divisions, see Table 1.

There is no absolute northern limit to the distribution of fresh-water fishes except the northern limit of the continents. Species of Cyprinidae and Percidae are widely distributed in arctic Eurasia, and one American cyprinid and one percid (the pikeperch) probably enter the Arctic in western Canada, although neither family is yet known in Alaska. The trout-perch (Percopsidae), too, probably enters the Arctic in western Canada. The pike and one sucker occur above the Arctic Circle in western Canada, Alaska, and parts of northern Eurasia. And the blackfish *Dallia*, forming a monotypic family, is confined to subarctic and arctic Alaska and eastern Siberia. (Data from Evermann & Goldsborough, 1907; Berg, various papers; Cameron *et al.*, 1947; and E. B. S. Logier, letter.) Primary-division fishes like those mentioned are few in the far north, but peripheral fresh-water species swarm there. Southwards, primary-division fishes reach the tip of South Africa. They

TABLE 1

Existing fresh-water fishes of the world

This list includes all groups of the primary (1st) and secondary (2nd) divisions of fresh-water fishes, but only a few of the more important families of peripheral (per) fishes, and no marine ones; if all marine groups of which one or more members live in or enter fresh water were included, this table would be increased by something like 100 families! The classification follows Regan (1929), with a few changes and additions. Numbers of genera and species are, in the larger families, only approximations. Groups belonging to the great fresh-water order Ostariophysi are in bold-face. See text for further explanation.

Class AGNATHA, cyclostomes

(per) Petromyzonidae, lampreys: cool N. & S. hemispheres; ca. 8 genera, more than 20 species; anadromous and resident in fresh water

Class CHONDRICHTHYES, sharks, rays, etc.

(per) Potamotrygonidae, river rays: South America; ca. 3 genera, 14 species; related to marine sting rays

Class OSTEICHTHYES, bony fishes

(NON-TELEOSTEI, archaic bony fishes)

Order *Chondrostei*

(per) Acipenseridae, sturgeons: cool N. hemisphere; ca. 5 genera, 20 species; anadromous and resident in fresh water

(1st) Polyodontidae, paddle-fishes: one monotypic genus in China, another in eastern North America

Order *Cladistia*

(1st) Polypteridae, bichirs: Africa; 2 genera, ca. 13 species

Order *Protospondyli*

(1st) Amiidae, bowfins: E. North America; one existing species

Order *Ginglymodi*

(2nd) Lepisosteidae, garpikes: E. North America, Central America, Cuba; one genus, 4 or 5 species

Order *Dipnoi*

(1st) Ceratodontidae, lungfishes: Australia; one existing species

(1st) Lepidosirenidae, lungfishes: one genus, 3 species in Africa; another genus, one species in South America

(TELEOSTEI, higher bony fishes)

Order *Isospondyli*

(per) Salmonidae, Coregonidae, Phyllogephyridae (Thymallidae); salmon, trout, etc.: cool N. hemisphere; many genera and species; anadromous and resident in fresh water

(per) Galaxiidae, Aplochitonidae, Retropinnatidae; "southern trout" etc.: cool S. hemisphere; ca. 7 genera, 50 species; catadromous and resident in fresh water

(1st) Phractolaemidae, Pantodontidae, Gymnarchidae, Kneriidae, Mormyridae: Africa; first 3 families, monotypic; Kneriidae, ca. 3 genera, 6 species; Mormyridae, ca. 10 genera, 150 species

(1st) Notopteridae: Africa, Orient; ca. 2 genera, 5 species

(1st) Osteoglossidae: one monotypic genus in Africa; another genus, 2 species in the Orient and Australia; 2 monotypic genera in South America

(1st) Hiodontidae, moon-eyes: E. North America; ca. 2 genera, 3 species

Order *Haplomi*

(1st) Umbridae, Dallidae, Esocidae; mud-minnows, blackfish, pikes: cool N. hemisphere; 4 genera, ca. 10 species

Order **Ostariophysi**

(1st) **Siluroidea** (part), 22 fresh-water families, catfishes: the continental regions excepting the Australian; more than 200 genera, ca. 1800 species

(per) *Siluroidea* (part), 2 *marine* families, catfishes: warm seas and remote fresh waters including Australia; numerous genera, ca. 150 species

(1st) **Characiformes**, 6 families, characins: Africa, South & Central America; more than 100 genera, ca. 950 species

(1st) **Gymnotiformes**, 4 families, gymnotid eels: South & Central America; ca. 17 genera, 35 species

(1st) **Cypriniformes**, 4 families, as follows: **Catostomidae**, suckers etc.: 2 genera, 2 species in E. Asia; ca. 18 genera, 84 species in North America; **Homalopteridae**: Orient, ca. 17 genera, 50 species; **Cobitidae**: numerous in Orient, fewer in temperate Eurasia, northern Africa; many genera and species; **Cyprinidae**, carps etc.: diverse and numerous in tropical and temperate Eurasia, fewer in Africa and North America; many genera, ca. 1,700 species

TABLE 1—*continued*

Order *Apodes*

(per) Anguillidae, true eels: discontinuous tropical and temperate areas; one genus, few species; catadromous

Order *Cyprinodontes*

(1st) Amblyopsidae, cave fishes, etc.: E. North America; ca. 4 genera, 9 species

(2nd) Cyprinodontidae, etc., top-minnows: the continental regions excepting the Australian; and some islands, including Celebes, Madagascar, and the Seychelles, and some West Indies and Bermuda; many genera & species

(2nd) Poeciliidae, etc., viviparous minnows: Americas, including West Indies in part; many genera and species

Order *Salmopercae*

(1st) Percopsidae, trout-perches: North America; 2 monotypic genera

(1st) Aphredoderidae, pirate-perches: E. North America; one species

Order *Percomorphi*

(1st) Centrarchidae, basses, sunfishes: North America; ca. 19 genera, 40 species

(1st) Percidae, perches: cool N. hemisphere; 5 genera, 11 species in Eurasia; none in Pacific drainage of W. North America; ca. 34 genera, more than 100 species in E. North America

(1st) Nandidae: Africa, Orient, South America; each region with one or 2 genera, each genus with one or 2 species

(1st) Pristolepidae: Orient; 1 genus, ca. 4 species

(2nd) Cichlidae: Africa, Syria, etc.; Madagascar, Ceylon, S. India; South & Central America to the Rio Grande; Cuba, Hispaniola; many genera and species

(per) Gobiidae, etc., gobies: tropical and temperate seas, and fresh waters especially in the tropics; many genera and species; some fresh-water forms are catadromous, others resident

(per) Atherinidae, silversides: tropical and temperate coastal seas and scattered fresh waters; 39 genera, about half of them confined to fresh water

(1st) Anabantidae, Channidae (Ophicephalidae), Luciocephalidae; labyrinth fishes: Old World tropics and temperate eastern Asia; ca. 15 genera, numerous species

Order *Scleroparei*

(per) Cottidae, sculpins, etc.: cool N. hemisphere, and one off the coast of Chile (Norman, 1938); many marine, a few resident in northern fresh waters; the related Comephoridae and Cottocomephoridae, with ca. 7 genera, 12 species, confined to Lake Baikal in Siberia

(per) Gasterosteidae, sticklebacks: cool N. hemisphere; few genera and species, some marine, some entering or resident in fresh water

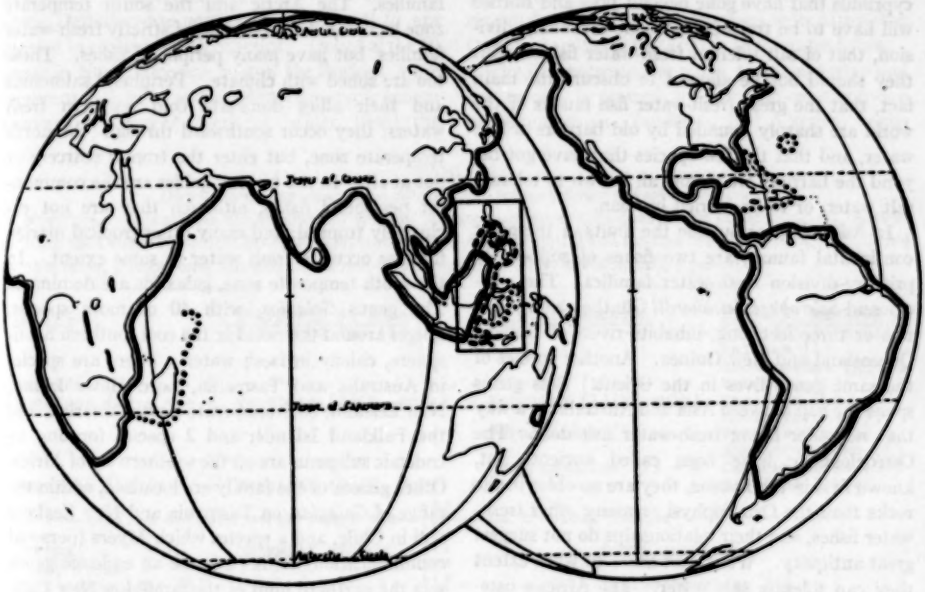
Order *Opisthomi*

(1st) Mastacembelidae, spiny eels: Old World tropics and temperate E. Asia; 2 genera, numerous species; the related Chaudhuriidae, one species, known only from Inlé Lake, Burma

are absent in most of Australia, but not because of cold climate. In South America, a catfish of the family Pygidiidae reaches 47° 30′ S., some 500 miles short of Cape Horn (Eigenmann, 1918, p. 269). It is probably the most southern true fresh-water fish in the world, but peripheral fishes occur in fresh water as far south as there is any. The ability of fishes to exist in very cold climates is due partly to the protection against cold afforded by deep water, but *Dallia* inhabits the shallowest sort of water on arctic tundras, and freezes solid in winter.

Great faunas of true fresh-water fishes are confined to the continents, excepting Australia, and to islands that have recently been parts of continents (Fig. 1). No fact in zoögeography is more striking than this. Some South American groups reach Trinidad, but not one of the many primary-division families of North or South America reaches the West Indies proper, although a few secondary-division stocks do so. No true fresh-water fishes of Africa reach Madagascar, except again some secondary-division stocks. Some primary-division families of Europe and Asia reach the British Isles, Japan, Formosa, Hainan, and Ceylon; and many tropical Oriental families range over Sumatra, Java, and Borneo. Here, however, most of them stop. No primary-division fish reaches Celebes. Celebes does have a few secondary-division Cyprinodontes, but even they go no farther east. A few small cyprinids go beyond Java on the Lesser Sunda chain: 2 are known on Bali, 2 on Lombok, and one on Sumbawa; none is endemic (de Beaufort, 1913). A very small fraction of the Bornean fauna reaches the southern Philippines: 2 endemic genera of silurid catfishes are on Palawan and the Calamianes Islands; one endemic species of clariid catfish is on Mindanao; and certain cyprinids are on the Palawan-Mindoro chain and on Mindanao (Herre, 1928). These fishes belong to families of

Myers' *primary* division. Either they have crossed land bridges that most Bornean fishes failed to cross, or they have gotten over barriers of salt water. One small cyprinid, *Puntius* ("*Barbodes*") *binotatus* (C.V.), which occurs in fresh water from Singapore through Sumatra, Java, and Borneo, has gone beyond the limits of most fresh-water fishes in three separate directions: to Bali and Lombok, to Palawan, and to Mindanao, where it is the apparent ancestor of a whole fauna of cyprinids which has evolved in Lake Lanao (Herre, 1933). It is too much to suppose that accident has singled



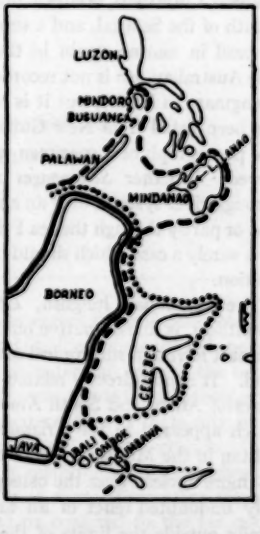


FIG. 1. LIMITS OF DISTRIBUTION OF PRIMARY- AND SECONDARY-DIVISION FRESH-WATER FISHES

——— Limits of primary-division fishes; or, in East Indies, limit of main primary-division fauna

— — — Limit of primary-division stragglers in East Indies

····· Limits of secondary-division fishes on islands

The occurrence of one primary-division fish, the ceratodontid lungfish, in eastern Australia is shown. The occurrence of an osteoglossip in northeastern Australia and New Guinea is not shown; it is doubtful if this fish really belongs in the primary division.

out this one species three times; there is probably a discoverable reason why it has attained its present range. It would be most interesting to know its salt-tolerance! Possibly the few catfishes and cyprinids that have gone beyond Java and Borneo will have to be transferred to the secondary division, that of salt-tolerant fresh-water fishes. But they should not be allowed to obscure the main fact, that the great fresh-water fish faunas of the world are sharply bounded by old barriers of salt water, and that the few species that have got beyond the barriers are almost all known to tolerate salt water, or to be carried by man.

In Australia, far outside the limits of the great continental faunas, are two fishes of supposedly primary-division fresh-water families. The osteoglossid *Scleropages leichhardti* Günther, a large fish two or three feet long, inhabits rivers of tropical Queensland and New Guinea. Another species of the same genus lives in the Orient. This genus spans the gap between Asia and Australia in a way that no other living fresh-water fish does. The Osteoglossidae have been called ancient, but, known first in the Eocene, they are no older in the rocks than the Ostariophysi or many other fresh-water fishes, and their relationships do not suggest great antiquity. We do not know to what extent they can tolerate salt water. The African osteoglossid, *Clupisudis*, occurs in brackish water at the mouth of the Senegal, and a supposed osteoglossid is fossil in marine strata in the English Eocene. The Australian fish is not recorded from salt water (Longman, in letter), but it is not well known; it has been listed from New Guinea on the basis of one photograph of a specimen which was not preserved! Whether *Scleropages* reached Australia through river systems over an ancient land connection or partly through the sea I shall not try to say. It is surely a case which should be interpreted with caution.

The Australian lungfish, *Epiceratodus forsteri* (Günther), is known native only in the Mary and Burnett Rivers of subtropical southeastern Queensland. It is not directly related to the living lungfishes of Africa and South America, but to fossils which appeared in the Triassic and were cosmopolitan in the Mesozoic. It is a relict incomparably more ancient than the osteoglossids. It is the only undoubted relict of an ancient fresh-water family outside the limits of the great continental fish faunas.

Within the limits described above, fresh-water fishes range along climatic zones more than along continuity of land. The north temperate zone and the tropical zone of the world have great, distinct assemblages of primary- and secondary-division families. The Arctic and the south temperate zone lack well defined faunas of strictly fresh-water families, but have many peripheral fishes. These too are zoned with climate. Peripheral salmonids and their allies dominate cold northern fresh waters; they occur southward through the north temperate zone, but enter the tropics scarcely or not at all. In the tropics, gobies are the commonest peripheral fishes, although they are not exclusively tropical; and many other tropical marine families occur in fresh water to some extent. In the south temperate zone, galaxiids are dominant. The genus *Galaxias*, with 40 or more species, ranges around the world in the cool southern hemisphere, chiefly in fresh water. There are species in Australia and Tasmania, Lord Howe Island, New Zealand, cold-temperate South America, and the Falkland Islands; and 2 species forming an endemic subgenus are on the southern tip of Africa. Other genera of the family are localized, within the range of *Galaxias*, on Tasmania and New Zealand and in Chile, and a species which Myers (personal communication) thinks may be an endemic genus sets the northern limit of the family on New Caledonia, just within the tropics. The family is considered to be of marine origin, just completing the process of establishing itself in fresh water. Some *Galaxias* still breed in the sea. One species which does so, *G. attenuatus* (Jenyns), enters fresh water with only a slight differentiation of races in southern Australia, New Zealand, and southern South America (Regan, 1905, p. 364).

Many marine fishes, too, are zoned with climate: the great shore-fish faunas of the tropics around the world are remarkably similar in many respects, and are relatively distinct from the temperate faunas immediately north and south of them (Myers, 1940). That so many peripheral and marine fishes, which can disperse through the sea, tend to be confined to one climatic zone or another shows that climate has a profound influence on their distribution. I think that climate probably has an equally profound influence on the distribution of true fresh-water fishes, although its importance is not often recognized.

For further discussion, I shall divide primary-division fishes into two groups: in one go all except

the order Ostariophysi; in the other, the Ostariophysi alone.

The distribution of non-ostariophysan, primary-division fresh-water fishes follows climate closely (Table 2). Ten families of them (not counting arctic Dalliidae) are north temperate. All 10 are present in eastern North America. Only 4 of the 10 occur in North America west of the Rockies: 3 are represented there by single, relict, monotypic genera localized in different rivers (cf. Miller, 1946); the fourth (Esocidae) reaches western drainage only in Alaska. [The eastern trout-perch (Percopsidae), too, may reach the west coast of Alaska; it is reported from the upper Yukon by Cameron et al., 1947.] Only 4 of the 10 occur in Eurasia: the Esocidae and Percidae are widely distributed across northern Eurasia; the Polyodontidae and Umbridae are represented by single relict species in China and eastern Europe respectively. Sixteen families are tropical: 13 of them occur in Africa; 9, in the Orient (6 shared with Africa); and 3, in South America (all shared with Africa and 2 also with the Orient). The 7 peculiar African families all belong to ancient or generalized orders, and include some strikingly archaic relicts. The 3 peculiar Oriental families are higher, spiny-rayed forms, perhaps of more recent, local origin. As compared with Africa, the Orient has notably few archaic fresh-water fishes.

The line between the north temperate zone and the tropics is crossed by few non-ostariophysan primary-division families. In America, none crosses it; none even enters Central America. In Africa, some tropical families follow the Nile nearly to its mouth, and so enter the edge of the north temperate zone, but none occurs in truly temperate waters. Only in eastern Asia is there any overlapping of temperate and tropical groups. Of 3 temperate families in eastern Asia, none reaches the tropics, and all are in fact either relict (Polyodontidae in China) or confined to the far north (Esocidae in the Amur and northward; Percidae only north of the Amur). But of the 9 tropical

TABLE 2

Distribution of existing non-ostariophysan primary-division fresh-water fishes

Numbers in parentheses are numbers of species, but are only approximations in the larger families. Arrows indicate the Oriental families that enter temperate eastern Asia. Central and western temperate Asia, not covered by this table, possess only one additional non-ostariophysan primary-division fish, a percid.

EUROPE	TEMPERATE E. ASIA	W. NORTH AMERICA	E. NORTH AMERICA
	Polyodontidae (1)		Polyodontidae (1)
			Amiidae (1)
			Hiodontidae (2)
Umbridae (1)		Umbridae (1)	Umbridae (2)
Esocidae (1)	Esocidae (2)(N. only)	Esocidae (1)(N. only)	Esocidae (5)
			Amblyopsidae (9)
		Percopsidae (1)	Percopsidae (1)
			Aphredoderidae (1)
		Centrarchidae (1)	Centrarchidae (40)
Percidae (10)	Percidae (2)(N. only)		Percidae (100+)

----------line between north-temperate and tropical faunas----------

AFRICA	ORIENTAL REGION	SOUTH AMERICA
Archaic forms		
Lepidosirenidae (3)		Lepidosirenidae (1)
Polypteridae (13)		
Isospondyli		
Phractolaemidae (1)		
Pantodontidae (1)		
Gymnarchidae (1)		
Mormyridae (150)		
Kneriidae (3)		
Notopteridae (2)	Notopteridae (3)	
Osteoglossidae (1)	Osteoglossidae (1)	Osteoglossidae (2)
Higher, spiny-rayed forms		
Nandidae (1)	Nandidae (4)	Nandidae (2)
	Pristolepidae (4)	
Anabantidae (16)	Anabantidae (25)	
	Luciocephalidae (1)	
Channidae (3)	Channidae (20)	
Mastacembelidae (34)	Mastacembelidae (num.)	
	Chaudhuriidae (1)	

Oriental families, 3 enter the temperate zone: the Anabantidae and Mastacembelidae reach North China; the Channidae (Ophicephalidae), the Amur. These families lack endemic temperate genera, and there is little endemism even of species near their northern limits; and their temperate ranges are much smaller than, and continuous with, their great ranges in the Old World tropics. The indications are that, in eastern Asia, temperate families have withdrawn and tropical families have pushed northward into the temperate zone.

The non-ostariophysan fresh-water fishes have had diverse origins. Existing stocks of lungfishes and perhaps bichirs may have evolved continuously in fresh water, but each of the other main groups has probably come independently from the sea, although when and where they did so is unknown. Fossils show two things: first, that some families have existed in the north temperate zone since the Eocene, and that during the Tertiary they have tended to withdraw from Eurasia and from western North America and to survive in eastern North America, and the distribution of surviving forms (Table 2) strikingly confirms such withdrawal; second, that two families have withdrawn from still greater areas. The Osteoglossidae, whatever their origin, have withdrawn from the north temperate zone and have survived in the tropics during the Tertiary. Ceratodontid lungfishes, which apparently occurred over the whole world in the Mesozoic, have dwindled to one species, in two small Australian rivers.

The order Ostariophysi is characterized by the chain of Weberian ossicles which connects the air-bladder with the inner ear. This structure is thought to improve hearing and to be an adaptation to life in fresh water, and it is believed that the Ostariophysi, although probably derived from marine Isospondyli, had a single origin in fresh water in a single region, from which they have dispersed. This single order contains about seven-eighths of the true fresh-water fishes of the world: some 4,500 species in about 36 families. It contains also 2 families, the ariid and plotosid catfishes, with about 150 species, which have gone back into the sea, and some of them have re-entered fresh water in such remote places as Madagascar and Australia. Except for them, the representatives of the Ostariophysi have the same general limits of distribution as other true fresh-water fishes.

There are two suborders of the Ostariophysi. One contains the catfishes, with about 22 fresh-water families, distributed as follows: in Africa, 6; in the tropical Orient, 9 (3 shared with Africa); in South America, 9 (all peculiar except that some range north into or through Central America). One of the families (Bagridae) common to Africa and the Oriental Region ranges north in eastern Asia to the Amur, another (Siluridae) characteristic of the tropical Orient occurs sparingly through temperate Eurasia north to the Amur and west to the Rhine, and a third tropical Oriental family (Sisoridae) is represented north to the Yangtse Kiang and in central Asia north of the Himalayas. There are some endemic species of these families in north temperate Eurasia, but apparently no endemic genera. Finally, the Ameiuridae are confined to North America south to Guatemala, but are apparently related to Old World bagrids. Fresh-water catfishes, then, are chiefly tropical. The four families represented in the north temperate zone are distributed or related as if they had come from southeastern Asia.

The other suborder of the Ostariophysi contains three "divisions." The first, the Characiformes, with 6 families, is confined to Africa and South and Central America, north to the Rio Grande. The second, the Gymnotiformes, with 4 families, is probably derived from the Characiformes and is confined to South and Central America north to Guatemala. The third, the Cypriniformes, contains 4 families.

The first family of the Cypriniformes is the Catostomidae, already discussed. This family occurs chiefly in North America south to Guatemala, but has one apparently relict and one immigrant species in eastern Asia. The Homalopteridae is all Oriental, north only to the Yangtse Kiang. The Cobitidae is chiefly tropical Oriental, but a few species occur north to the Amur, west over the whole width of Asia and Europe, and in northern Africa. Finally, the carp family, the Cyprinidae, the greatest of all fresh-water fish families, consists (according to Regan) of 3 subfamilies. Two of them are chiefly tropical Oriental but are represented also in temperate Eurasia and in Africa; the third is dominant in and almost restricted to the north temperate zone of Eurasia and North America, south to southern Mexico. The Cypriniformes that have reached tropical Africa seem to have done so along the southern edge of Eurasia, not through the colder temperate zone. Cyprinids appear to have spread from Eurasia, where they are fossil in

the Eocene, to North America, where they are unknown below the Miocene. In discussing the distribution of cyprinids I have used the classification of Regan (1922) rather than that of Nichols (1938) because the latter gives little distributional information.

Fossil Ostariophysi are known from many Tertiary deposits. They carrry the history of the order back to the Eocene. Most of the Eocene fossils belong to existing genera, so the order probably dates from the Cretaceous. In Regan's time (1922) no fresh-water family of Ostariophysi was known fossil outside of its present range. One or two exceptions to this rule are known today, but the fossil record still suggests that the Ostariophysi are a chiefly expanding group, and so, I think, does the distribution of existing forms.

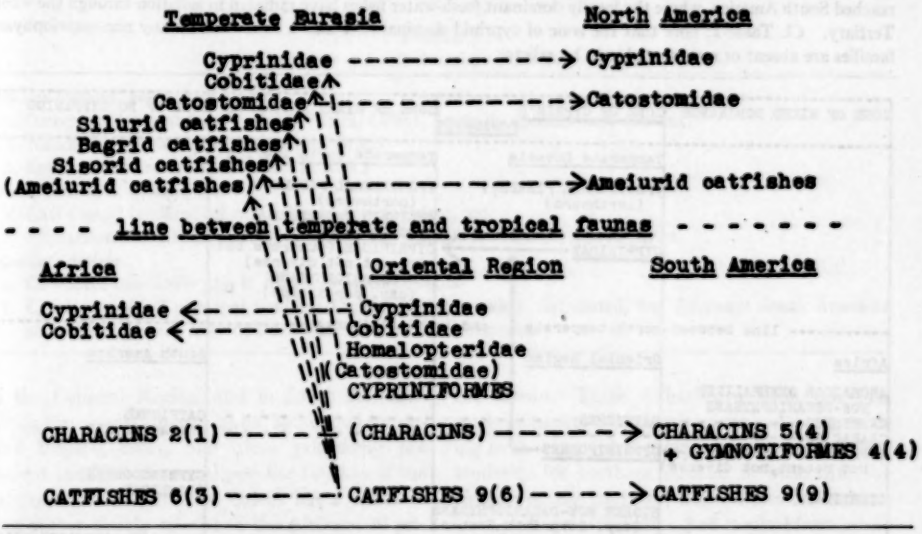
There are obvious points of contrast between the distributions of non-ostariophysan fresh-water fishes and of the Ostariophysi. The non-ostariophysans have had diverse origins, have been retreating during the Tertiary, and have come to be completely zoned with climate, except that three tropical families range northward into temperate eastern Asia. The Ostariophysi have had a single origin, have been chiefly expanding during the Tertiary, and, although some families are zoned with climate, others have spread extensively across climatic boundaries. The distribution of the latter families suggests radiation in all possible directions from a main Tertiary center in the Oriental tropics (Table 3).

The secondary division, of somewhat salt-tolerant fresh-water fishes, contains three groups. The Lepisosteidae occur in eastern North America and Central America, north to the Great Lakes and south to Panama, and in Cuba; they are fossil in North America, temperate Asia, and Europe in the late Cretaceous and Eocene; they are an old north temperate family which has, apparently, pushed farther into the tropics than any other northern fresh-water fishes, but they have not reached

TABLE 3

Present distribution and apparent chief lines of dispersal of fresh-water Ostariophysi

Names in parentheses indicate presumed former occurrence of groups in regions where they no longer exist. Figures show numbers of families of characins and tropical catfishes in each region; figures in parentheses, numbers of families peculiar to each region. The table does not attempt to show *slight* invasions of the north temperate zone by certain tropical families (*e. g.*, by the Homalopteridae, which reach the Yangtse Kiang; and by a family of characins, which reaches the Rio Grande) nor *slight* invasion of the edge of the tropics by two temperate North American families (Ameiuridae and Catostomidae, both of which reach Guatemala).



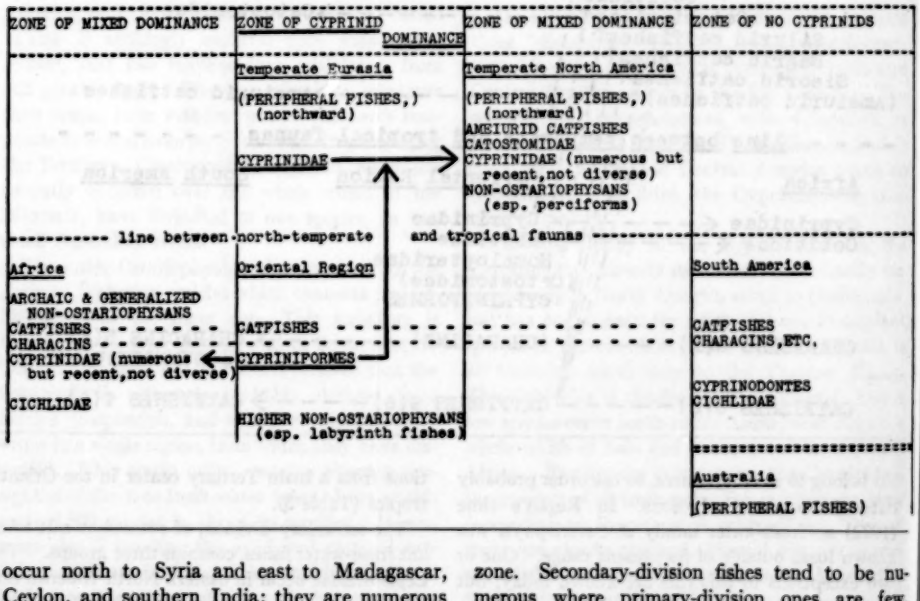
South America and do not compete with the main South American fish fauna. The Cyprinodontes, with several families, are characteristic of the tropics of the world, excepting the Australian Region, but they occur also north and south of the tropics well into the temperate zones, especially in America. Cichlids are numerous in Africa and American lakes, and also of Central America and southern Mexico, where primary-division fishes are peculiarly few.

Obviously, the three divisions of fresh-water fishes tend to have complementary distributions. Peripheral fishes tend to replace true fresh-water ones toward the Arctic and in the south temperate

TABLE 4

Dominant groups of fresh-water fishes of main continental areas

This table is designed to show the geographic relationships of cyprinids to other dominant, presumably sometimes competing groups of fresh-water fishes. The criterion of dominance is number and diversity of species. Species of Cypriniformes are extraordinarily numerous and diverse in the Oriental Region, where they probably originated or at least attained dominance, and where they may have replaced several groups of fresh-water fishes which are still dominant in Africa and/or South America. From the Orient, the Cyprinidae has invaded and diversified in temperate Eurasia, where, as dominant fresh-water fishes, they have replaced all other families except peripheral ones. From the main zone of cyprinid dominance in the Orient and temperate Eurasia, cyprinids have spread probably comparatively recently to Africa and North America; on these continents they are numerous but not yet diverse, and they share dominance with numbers of other fishes. Cyprinids have not reached South America, where the locally dominant fresh-water fishes have radiated in isolation through the whole Tertiary. Cf. Table 2: note that the zone of cyprinid dominance is also a zone where many non-ostariophysan families are absent or represented only by relicts.



occur north to Syria and east to Madagascar, Ceylon, and southern India; they are numerous also in South and Central America and reach their northern limit in the Rio Grande, and occur on Cuba and Hispaniola. As a group, secondary-division fishes are characteristic especially of certain island, including Madagascar and some of the West Indies, and of isolated African and South

zone. Secondary-division fishes tend to be numerous where primary-division ones are few. Within the primary division, the distributions of cyprinids and of certain other related and unrelated fresh-water fishes are strikingly complementary (Table 4). Cyprinids and their immediate allies dominate the tropical Orient and, even more, temperate Eurasia, but are fewer in Africa

and North America and absent in Central and South America. As *dominant* fishes, they are complementary in the tropics to characins and cichlids, which occur entirely or chiefly in Africa and tropical America, and in the north temperate zone they are more or less complementary to the Catostomidae and certain non-ostariophysan families which are dominant in and nearly or quite confined to North America. That some of these complementary groups compete, and that spread of one may cause withdrawal of another, is hard to doubt. However, competition is apparently not at narrow lines but in large areas and over long periods of time.

The relationships of tropical fresh-water fishes, and the origin of those of South America, are special, intriguing problems. In the tropics there are three great faunas of fresh-water fishes, in Africa, in the Oriental Region, and in South America. Africa has an old, diverse fauna, lacking no important tropical order, and alone possessing the ancient bichirs and several peculiar families of the Isospondyli. The tropical Orient has a fauna in part rather closely related to the African; 10 primary-division families and some genera are the same; but the Orient lacks most of the older African groups, the lungfishes, bichirs, and most of the African Isospondyli, and lacks also the more recent characins and, except in southern India, cichlids; and the Orient is uniquely rich in the Cypriniformes. South America has a fauna which is perhaps richest of all in endemic species, genera, and even families, but poorest in origins. South American primary- and secondary-division fresh-water fishes belong to only 7 basic groups (Table 5). All 7 are related in some way toward Africa. The relationships are apparently old; only 4 primary- and 2 secondary-division families are common to South America and Africa, and there is no common genus. Of course, South America lacks some African groups, including some ancient ones, and also lacks the Cypriniformes. In contrast to the all-pervading African relationship, there seems to be no direct relationship whatever between the South American families of fresh-water fishes and living, truly North American families, except in the salt-tolerant order Cyprinodontes.

Matthew (1915, pp. 297–299; 1939, pp. 127–130) believed that the main groups of fresh-water fishes have evolved in the north temperate zone, and that a succession of them has descended into the tropics and persisted there as relicts, but this belief is against the evidence. Matthew's statement of supposed fossil evidence is almost wholly a list of errors, as Myers (1938, pp. 351–2, with footnote 18) has shown. There is hardly a fossil fish that really supports Matthew's views. Among existing fresh-water fishes there has *not* been a general tendency for northern families to push into the tropics; on the contrary, tropical families seem to have pushed northward. And tropical fresh-water fishes have direct and simple relationships, ancient ones between Africa and South America which involve the whole South American fauna but only a part of the African, and more recent ones between Africa and the Orient. This is not a pattern of relicts; it is too orderly. The pattern suggests a passage of fresh-water fishes first between Africa and South America and later between Africa and the Orient.

Passage of fresh-water fishes between Africa and South America might conceivably have occurred in either direction. All of a limited South American fish fauna might have reached Africa; or part

TABLE 5

The groups of South American fresh-water fishes

Primary division, non-ostariophysans

1. Osteoglossidae: one family, also in Africa, Orient, Australia (perhaps salt tolerant)
2. Nandidae: one family, also in Africa, Orient
3. Lepidosirenidae: one family, also in Africa

Primary division, Ostariophysi

4. Catfishes: 9 families; other families in Africa, Orient, etc.
5. Characiformes, with derived Gymnotiformes: 9 families; characins also in Africa

Secondary division

6. Cichlidae: one family also in Africa to southern India
7. Cyprinodontes: 2 principal families; Cyprinodontidae widely distributed, but dominant South American and African genera related; Poeciliidae also in North America

of a larger African fauna, South America. I think that the latter is more likely, and that, probably in the Cretaceous, a few tropical fishes of a diverse African fauna reached remote South America and radiated to form the present South American fauna, in which one group, the characins plus gymnotid eels, has far outstripped its African relatives. This is just the sort of thing that does happen when a few fishes of a large fauna reach isolated waters.

I can only guess at the routes the fishes may have followed from Africa to South America. They may have gone partly through the sea, if they had a little salt tolerance, or they may have crossed an old Africa-South America land connection, if one existed. Otherwise, they passed through the northern hemisphere; but that need not mean that they originated there.

HYPOTHETICAL HISTORY OF DISPERSAL OF FRESH-WATER FISHES

The following is a tentative history of the dispersal of fresh-water fishes. I shall begin in the Cretaceous, assuming the existence then of a variety of non-ostariophysan fresh-water families, of diverse origin, mostly zoned with climate. During the Cretaceous, the order Ostariophysi originated in fresh water, probably in the Old World tropics, and split into catfishes and characins, and parts of the resultant Old World tropical fauna of non-ostariophysan fishes plus primitive ostariophysans reached South America. If they did so over existing continents, they probably went by way of eastern Asia, crossed to North America at a time of favorable climate, and followed the west coast of North America to Central and South America. Only those tropical fishes that had some toleration for coolness could follow this route, and even they might have been barred from most of the north temperate zone, not by physical barriers, but simply because they were tropical fishes. Two facts are worth remembering in this connection. Several existing families of tropical fresh-water fishes do range north through eastern Asia to the Amur, which is at the level of southern Alaska. And three notably cold-tolerant species of existing north temperate primary-division fishes did filter across a late, cold Bering bridge, as a few cool-tolerant tropical species may have filtered across an earlier, warmer bridge. Later, about the beginning of the Tertiary, the Catostomidae evolved presumably from characins in southeastern Asia, and catostomids and ancestral ameiurid catfishes moved from Asia to North America. During the Tertiary, the Cyprinidae, evolving in turn apparently from the Catostomidae, radiated explosively in the Orient, flooded the whole of Eurasia, and entered Africa and North America. The cyprinids replaced many older fishes, including characins, cichlids, and most older fresh-water families in the tropical Orient, and most catostomids and several non-ostariophysan groups in temperate Eurasia. The destruction of the older fishes in the Orient and temperate Eurasia, and also in western North America and Central America, was furthered by geological and climatic changes, so that the old tropical fauna of the Cretaceous survived chiefly in Africa and, in a partial and derivative form, in South America.

This history is hypothetical. It agrees with many facts, but I shall not try to prove it by remarshalling them. I suggest that the reader review, with this history in mind, what has been said about fresh-water fishes in preceding pages, and what Regan (1922) says about the Ostariophysi. Regan should be read for his facts, not his theories.

This hypothesis assumes and stresses certain things. It assumes that climate is fundamentally important to fresh-water fishes, and that climatic zones have existed since the Cretaceous, oriented as now, but varying in intensity and in detail. It assumes that fishes compete, and that the spread of some families causes a retreat of others. It stresses the Old World tropics, and during the Tertiary especially the Oriental tropics, as the main center of the evolution and dispersal of fresh-water fishes, so far as there has been one main center. It stresses the north temperate zone as a filter bridge for tropical fishes, and not as their place of origin.

The distribution of relict fresh-water fishes remains to be discussed. There are no ancient relicts of the Agnatha or Chondrichthyes in fresh water. Existing fresh-water members of these classes appear to have come more or less recently from the sea. Among bony fishes, all the non-Teleostei (cf. Table 1) are phylogenetic relicts. They are few. In the primary division of fresh-water fishes are only the Polyodontidae, with one monotypic genus in China and another in eastern North America; the Polypteridae, with 2 genera, 13 species in Africa; the Amiidae, with a single species in eastern North America; lepidosirenid lungfishes, with one genus, 3 species in Africa and another, monotypic genus in South America; and ceratodontid lungfishes, with one species localized

in Australia. In the secondary division is only the Lepisosteidae, with one genus, 4 or 5 species in eastern North America, Central America, and Cuba. Of these fishes, only the Australian lungfish is geographically isolated. All the others live with great faunas of true fresh-water fishes, some in the full tropics, some in the north temperate zone. Some, notably the lungfishes, may be protected from competition with most other fishes by special adaptations and modes of life, but others are not. *Amia calva* L., although the only relict of an order which dominated Jurassic seas and was once widely distributed in fresh water in the north temperate zone, exists without visible special protection in the present, rich fresh-water fish fauna of eastern North America.

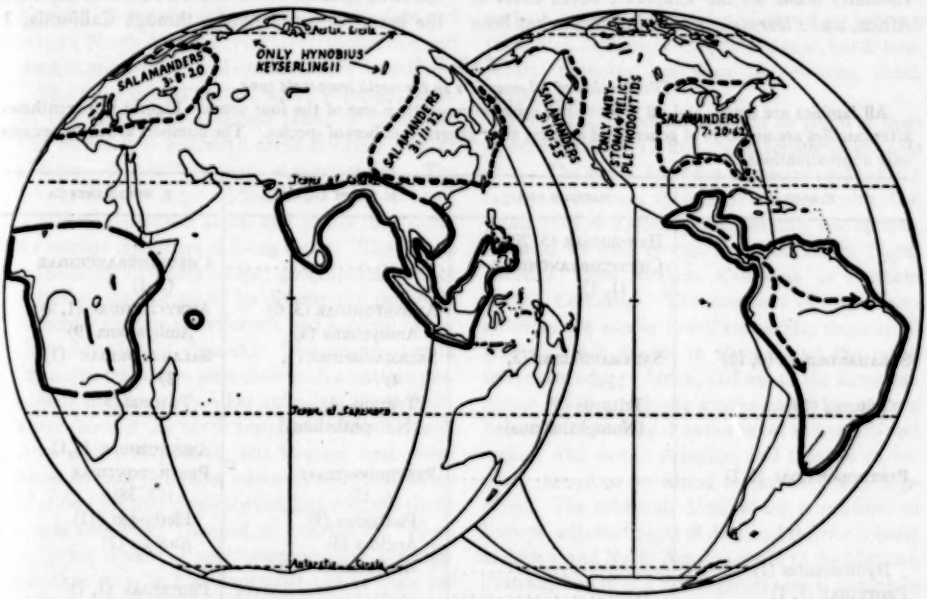


FIG. 2. GEOGRAPHICAL DISTRIBUTION OF CAECILIANS AND SALAMANDERS
——— Approximate limits of distribution of caecilians
— — — Approximate boundaries of the four principal areas inhabited by salamanders in the north temperate zone; and routes of dispersal of *Oedipus* in Central and South America
Numbers, as 3:8:20, are numbers of families, genera, and species of salamanders in the areas shown.

AMPHIBIANS

I am indebted more than I can acknowledge in detail to Mr. Arthur Loveridge, Mr. Benjamin Shreve, Mr. Karl P. Schmidt, and Prof. E. R. Dunn for aid in obtaining and sifting information about amphibians and reptiles. Of published information about amphibians, the most important single source is Noble (1931).

There are three existing orders of amphibians: the Apoda or caecilians, the Urodela or salamanders, and the Anura or frogs and toads.

Caecilians (Fig. 2) are almost strictly tropical. They enter the edge of the north temperate zone only in northern India; of the south temperate, only in southern South America. The order contains a single family, the Caeciliidae, of some 17 genera and 73 known species, distributed as follows: in tropical Africa, 6 genera, 17 species; in Madagascar, none; on the Seychelles Islands in the Indian Ocean, one genus, 6 species (Parker, 1941); in the Oriental Region, from Ceylon and India to Java, Borneo, and the southern Philippines (Palawan, Mindanao), 4 genera, 6 species; through Bali and the other Lesser Sunda Islands, Celebes, and the Australian Region, none; in America, from southern Mexico to Buenoa Aires, 6 genera, 44 species, most in the tropics of the South American continent (Dunn, 1942); on the West Indies, excepting Trinidad, none. No genus is known with certainty to occur in more than one of these areas.

Living salamanders form 8 families, more than 40 genera, and nearly 200 species, plus additional subspecies. They are characteristic of the north temperate zone of the world (Fig. 2). *Hynobius keyserlingii* (Dybowski) of Siberia reaches the Arctic, but is perhaps the only salamander that does so. In Europe, salamanders reach about 63°N.; in western North America, hardly 60°; in eastern North America, perhaps not above 53°. Southwards, they about reach the Tropic in China and Formosa. Three European genera, 4 species (2 endemic) occur on the temperate north coast of Africa, and *Pleurodeles waltl* Michahelles has been reported from one locality in West Africa, in the tropics south of the Sahara, but one may doubt whether it is native there. In America, *Ambystoma* follows the Mexican Plateau across the Tropic of Cancer; and *Oedipus* (in a broad sense), with many species, ranges from southern Mexico to Bolivia and Pará, but belongs to an otherwise north temperate family. This genus, *Oedipus*, has probably spread in the tropics chiefly along connected mountain systems, but it has invaded the lowlands of Central America extensively and those of northern South America a little. No salamanders other than those mentioned are known anywhere in the tropics, and there is none at all in the south temperate zone. Old records of species from Siam, Haiti, and the La Plata region of South America have proved to be errors.

Within the north temperate zone (Table 6), salamanders occur as follows: in Europe and adjacent parts of western Asia and North Africa, 3 families, 8 genera, about 20 full species; in most of western, northern, and central Asia, only *Hynobius keyserlingii;* in eastern Asia, including the eastern Himalayas, China, and Japan, 3 families, 11 genera, about 32 species; in western North America, from the lower corner of Alaska through California, 3 families, 10 genera, 25 species; in west-central North America, including the Great Basin, Rocky Mountains, and Great Plains, only 2 wide-ranging species of *Ambystoma* and local, isolated populations of 2 or 3 species of plethodontids; in eastern North America, from the Ozarks and eastern Texas to the Atlantic, and from southern Canada to Florida, 7 families, 20 genera, 62 full species. It will be seen that north temperate salamanders are concentrated in four more or less separate areas: Europe, eastern Asia, western North America, and eastern North America.

A number of families and genera of salamanders

TABLE 6

Distribution of salamanders in the north temperate zone

All families are listed, and all genera that occur in more than one of the four areas. Figures in parentheses after families are numbers of genera and species; after genera, numbers of species. The numbers are in some cases only approximations.

EUROPE, etc.	EASTERN ASIA	W. NORTH AMERICA	E. NORTH AMERICA
	HYNOBIIDAE (5, 20)		
	CRYPTOBRANCHIDAE (1, 1)	.....	CRYPTOBRANCHIDAE (1, 1)
		AMBYSTOMIDAE (3, 6)	AMBYSTOMIDAE (1, 9)
		Ambystoma (4)	Ambystoma (9)
SALAMANDRIDAE (6, 18)	SALAMANDRIDAE (5, 11)	SALAMANDRIDAE (1, 4)	SALAMANDRIDAE (1, 3)
Triturus (10)	Triturus (3) (Notophthalmus)	Triturus (4) (Notophthalmus)	Triturus (3)
			AMPHIUMIDAE (1,1)
PLETHODONTIDAE (1, 1)	.....	PLETHODONTIDAE (6, 15)	PLETHODONTIDAE (13, 38)
		Plethodon (5)	Plethodon (11)
		Aneides (3)	Aneides (1)
Hydromantes (1)	.....	Hydromantes (1)	
PROTEIDAE (1, 1)	.....	.....	PROTEIDAE (1, 7)
			SIRENIDAE (2, 3)
3 FAMILIES (8, 20)	3 FAMILIES (11, 32)	3 FAMILIES (10, 25)	7 FAMILIES (20, 62)

have discontinuous ranges (Table 6), and fossils show that some of them once occurred far outside their present ranges: *e. g.*, the cryptobranchid *Megalobatrachus* and the salamandrid *Tylototriton*, both now confined to eastern Asia, are fossil in Europe in the Miocene. Moreover, geographical relationships of different groups run in every possible direction among the four areas of distribution. Salamandrids link Europe and eastern Asia; *Hydromantes*, Europe and western North America; proteids, Europe and eastern North America; one group of *Triturus*, eastern Asia and western North America; living cryptobranchids, eastern Asia and eastern North America; various plethodontids and *Ambystoma*, western and eastern North America.

The geographical pattern which is formed when an old, diverse, wide-spread fauna is decimated and forced into restricted areas is called a relict pattern. It has two main characteristics. The first is discontinuity; related forms tend to occur in widely separated areas, and fossils may occur far outside the ranges of living forms. The second is diversity of relationships; geographical ties of surviving forms tend to be diverse and confused, reflecting chances of extinction and survival rather than directions of dispersal. The salamanders in the north temperate zone show such a pattern perhaps better than any other animals. Some fresh-water fishes of the north temperate zone (Table 2) show a similar pattern, but tropical fresh-water fishes do not, but show instead simple and direct relationships that probably indicate comparatively simple and direct dispersal, as said before. From the point of view of world zoögeography, the salamanders may be less important per se than for emphasizing, by contrast, the striking orderliness of the relationships of tropical fresh-water fish faunas.

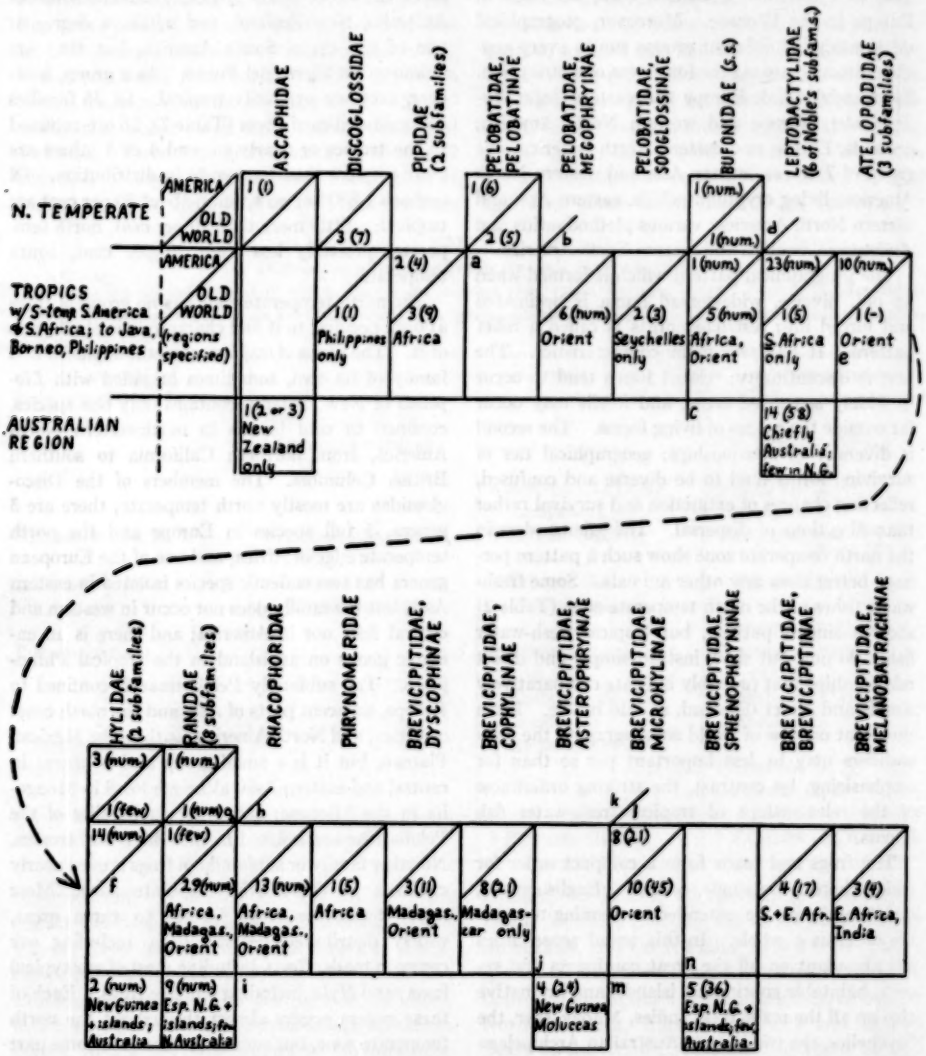
The frogs and toads form a compact order for which there is no single, inclusive English name, but "frogs" may be extended in meaning to cover the order as a whole. In this broad sense, frogs are abundant on all the great continents and recent, habitable continental islands, and are native also on all the main West Indies, Madagascar, the Seychelles, the whole Indo-Australian Archipelago through the Philippine and Solomon Islands (and perhaps the Fiji Islands), Australia, Tasmania, and New Zealand. Upon the continents, species of *Rana* reach the Arctic across Eurasia and in North America; *Bufo* approaches the Arctic (to 65°N.) in Europe and may reach it in western North America; and the hylid *Pseudacris* may reach it in western North America, although *Hyla* itself reaches only 57°N. in Europe and perhaps only 51° or 52° in America. Southwards, frogs reach the tip of South Africa, Tasmania south of Australia, New Zealand, and within a degree or two of the tip of South America, but they are unknown on Tierra del Fuego. As a group, however, they are primarily tropical. Of 36 families and subfamilies of them (Table 7), 26 are confined to the tropics or nearly so, and 4 or 5 others are more tropical than temperate in distribution. Of perhaps 1,800 known species, about 80 per cent are tropical; a little more than 10 per cent, north temperate; probably less than 10 per cent, south temperate.

The north temperate zone has no group of frogs at once peculiar to it and characteristic of all parts of it. The genus *Ascaphus*, sometimes placed in a family of its own, sometimes brigaded with *Liopelma* of New Zealand, contains only one species, confined to cold brooks in northwestern North America, from northern California to southern British Columbia. The members of the Discoglossidae are mostly north temperate; there are 3 genera, 5 full species in Europe and the north temperate edge of Africa, and one of the European genera has two endemic species isolated in eastern Asia; but the family does not occur in western and central Asia nor in America; and there is an endemic genus on an island in the tropical Philippines. The subfamily Pelobatinae is confined to Europe, adjacent parts of Asia and the north coast of Africa, and North America south to the Mexican Plateau, but it is a small group and is absent in central and eastern Asia, although fossil in Mongolia in the Miocene; and other subfamilies of the Pelobatidae are isolated in the Old World tropics. No other family or subfamily of frogs is even nearly confined to the north temperate zone. Most north temperate frogs belong to three great, widely distributed genera: *Bufo*, including our common toads; *Rana*, including most of our typical frogs; and *Hyla*, including our tree frogs. Each of these genera occurs almost throughout the north temperate zone, but each is dominant in some part of the tropics too, and all belong to tropical families. A few other tropical frogs occur northward locally. In the Old World, they do so only in eastern Asia, where the brevicipitid *Kaloula* reaches Manchuria; *Rhacophorus*, northern Honshu in Japan; three other tropical genera, central

TABLE 7

Distribution of families and subfamilies of frogs

Figures such as "3 (7)" mean 3 genera, 7 species known from the area indicated; "num." means numerous; "sev.", several.



a) *Scaphiopus* enters edge of tropics in central Mexico.
b) *Megophrys* enters edge of north temperate in China.
c) *Bufo* ranges to Celebes and Lombok.
d) Three genera enter edge of north temperate, to Texas, New Mexico.
e) See Davis, 1935.
f) *Hyla* enters north edge of tropics in southeast Asia.
g) A second genus (*Staurois*) enters edge of north temperate in China.

TABLE 7—*continued*

h) *Rhacophorus* ranges north to central China and Japan.

i) *Rhacophorus* ranges to Celebes, Timor.

j) *Metopostira* reaches the Sulu Archipelago in the southern Philippines.

k) *Microhyla* (*Gastrophryne*) enters north temperate in eastern United States; a second genus (*Hypopachus*) reaches southern Texas.

l) Two genera enter north temperate in eastern Asia: *Microhyla* reaches central China, Japan; *Kaloula*, Manchuria.

m) *Kaloula* reaches Celebes and Lesser Sunda Islands; *Microhyla*, Bali.

n) *Oreophryne* ranges east and north to Bali, Celebes, and Mindanao.

China. In America, three tropical genera of leptodactylids and one of brevicipitids reach Texas and in one case southern Arizona too, and a second brevicipitid genus, *Microhyla* (*Gastrophryne*), extends north and east to Kansas, Indiana, and Maryland. This completes the list of frogs of the north temperate zone, excepting a few that may just enter its southern edge.

The distributions of all existing frog families are outlined in the following paragraphs, *with reference particularly to the tropics and the south temperate zone.*

Species of the Ascaphidae do not occur in or even near the tropics; the two genera are localized in opposite habitats in opposite temperate zones. Aquatic *Ascaphus*, with one species, is in northwestern North America. Chiefly terrestrial *Liopelma*, with two or three species, inhabits New Zealand. *Liopelma hochstetteri* Fitzinger and *archeyi* Turbott (the two may be forms of one species) are localized on the north side of North Island (Turbott, 1942; Stephenson and Thomas, 1945). They frequent open, fog-dampened ridges as well as brooks, and one or both forms lay eggs on the ground under stones and logs. Each egg is surrounded by a capsule of fluid in which the tadpole transforms into a froglet. *L. hamiltoni* McCulloch is known only from small Stephen Island, in Cook Strait just north of South Island; Stephen Island is without surface water at some seasons. These are the only native New Zealand frogs.

The members of the Pipidae form two subfamilies, one confined to Africa south of the Sahara; the other, to a part of tropical South America. They are the most aquatic of frogs.

The Discoglossidae has one endemic genus and species on Busuanga Island north of Palawan in the Philippines (Myers, 1943), but the family is otherwise confined to disconnected areas in the north temperate zone of the Old World.

The Pelobatidae has one subfamily, with 6 genera and numerous species, in the eastern tropical Orient (*not* in Ceylon or peninsular India) north into the edge of the temperate zone in China. Another subfamily, with 2 genera, 3 species, is confined to the Seychelles Islands between India and Madagascar. The third subfamily is virtually confined to the north temperate zone, as already described.

Leptodactylids are absent in the main part of the Old World tropics and in all northern regions, but are fossil in the Eocene of tropical India. One endemic genus, with few species, is in South Africa. Many genera and species are in the Australian and tropical American regions.

Species of the Hylidae are nearly or quite absent in a great area from Africa south of the Sahara through the Oriental Region, except at its northern edge. Species of *Hyla* are numerous in the Australian Region (Australia, New Guinea, etc.); few, across the north temperate zone of the Old World, from Spain and the north coast of Africa to China and Japan (a fossil *Hyla* is recorded from the Miocene of Europe); and numerous, in north temperate and tropical America. Most other genera of the Hylidae are confined to tropical America.

Species of the Atelopodidae may occur in Africa; at least one species is in the tropical Orient (Davis, 1935); many genera and species are in tropical America. The family needs study.

The Brevicipitidae (Microhylidae) (Parker, 1934) forms 7 subfamilies, all represented in the Old World tropics, but most of them strikingly localized or with discontinuous ranges (Table 7). They are few in South and East Africa; absent elsewhere in Africa; numerous in Madagascar, the Orient, and New Guinea; few in tropical northern Australia; and absent in temperate Australia. One subfamily, Microhylinae, numerous in the tropical Orient, enters north temperate eastern Asia, reaching Manchuria. This is the only subfamily that occurs in America, where again it is chiefly tropical. One genus, *Microhyla* (*Gastrophryne*), is common to the Orient and America.

Most of its species in both areas are tropical, but one occurs north to central China; two, to Kansas and Indiana. The Phrynomeridae is related to the brevicipitids. The one genus, with few species, is widely distributed in Africa south of the Sahara.

The Bufonidae, Ranidae, and Rhacophoridae dominate both Africa south of the Sahara and the Oriental Region. Rhacophorids are numerous also on Madagascar; ranids, few there; bufonids, absent. The Ranidae alone of these families reaches the Australian Region, ranging through the whole Indo-Australian Archipelago to the Solomons (and to the Fijis, where they may have been carried by man), and at least one ranid reaches tropical northern Australia, but there is none in the main, temperate part of Australia. Of these three great families, only two genera range much beyond the limits of the Old World tropics, but these two are conspicuous. *Bufo* has many species not only throughout all of Africa and the Orient but throughout the whole north temperate zone and Central and South America; it is notably absent only in the Australian Region. *Rana* has many species throughout all of Africa and the Orient, into the tropical part of the Australian Region, through the whole northern hemisphere, and into Central America; and one species reaches northern South America. The genus is notably absent only in Australia below the tropics and in the southern half or more of South America.

Certain groups of frogs tend to be complementary either geographically or ecologically. Bufonids, ranids, and rhacophorids swarm in all habitats in Africa and tropical Asia; as dominant frogs they are complementary to leptodactylids and to *Hyla* in Australia and to these and other groups in South America. In the north temperate zone, *Bufo* and *Rana* are mostly terrestrial; *Hyla*, mostly arboreal. In the Australian Region, there is a three-way complementary arrangement: leptodactylids are mostly terrestrial (in the Australian Region) and are numerous in Australia, few in New Guinea; brevicipitids, also terrestrial, are numerous in New Guinea, few in Australia, and are in fact absent in temperate southern Australia; *Hyla*, mostly arboreal, is numerous in Australia *and* New Guinea (data from Parker, 1934 & 1940; and from my own field observations). In none of these cases do complementary groups meet at sharply defined boundaries; they overlap both geographically and ecologically. Presumably they compete, but they do so in broad zones rather than on narrow battle fronts. Competition may occur also between frogs and salamanders. That the former jump and that the latter do not does not change the fact that the requirements of typical forms of both orders are about the same, and that, typically, both have aquatic, probably sometimes competing larvae.

Matthew (whose knowledge of frogs was slight) and also Noble and Dunn have urged a northern origin of frog faunas, but I think they have been too ready to force cold-blooded frogs into the pattern of warm-blooded mammals. There is no fossil to show that any frog now confined to southern regions has originated in the north temperate zone. No group of frogs is distributed as if it had evolved in the north and recently pushed into the tropics. The groups that come nearest to being peculiar to the north (*Ascaphus*, Discoglossidae, Pelobatinae) represent three of the four most primitive families of Noble's (1931) classification. They are relicts. Matthew's stated belief (1915, p. 295; 1939, p. 125) that archaic frogs are limited to peripheral and isolated lands, is plainly wrong. Dominant northern frogs, *Bufo*, *Rana*, and *Hyla*, seem all to have come from the tropics, and other tropical genera seem to have pushed wedges northward in eastern Asia and eastern North America. All these facts speak against a northern origin of frog faunas. Pleistocene glaciation hardly accounts for the paucity of northern frogs. Many fresh-water fishes and many salamanders survived the Pleistocene in eastern North America, and frogs are better able than fishes to move before glaciers, and are more adaptable than salamanders. It looks to me as if frogs have always been, as they now are, primarily tropical animals, and as if successive tropical groups have invaded the north temperate zone.

Some persons have imagined spectacular land bridges in the southern hemisphere to account for frog distributions. The members of the aquatic Pipidae do link Africa and South America, but they parallel the distribution of fishes they live among, and I have tried to show that the fishes need not have crossed a direct land bridge. The Leptodactylidae and *Hyla* are dominant on South America and Australia, but they occur and are fossil in other places, and they are not on New Zealand. The presence on New Zealand of a different, primitive frog suggests that the leptodactylids and *Hyla* did not pass that way. Frogs, in my opinion, have required no extraordinary land bridges

and provide some evidence against them. [The latest attempt to explain frog distributions in terms of great land bridges is by Metcalf (1940), who has tried to correlate the distribution of frogs with that of their opalinid parasites. The attempt is not very successful, partly because of failure to use an up-to-date classification of frogs. What Metcalf says in 1940 is not very different from what he said in 1923, and what he said then has been adequately criticized in two papers written expressly for the purpose by Noble (1925) and Dunn (1925).]

HYPOTHETICAL HISTORY OF DISPERSAL OF AMPHIBIANS

Frogs probably originated in the Triassic or earlier and are definitely known from the Jurassic. Salamanders and caecilians may be equally old, but the former have not been found before the Lower Cretaceous (of Europe), and the latter are not surely known as fossils.

Frogs are descended from amphibians that had ribs and tails. Of existing frogs, the Ascaphidae alone retains both ribs and tail-wagging muscles; the discoglossids are ribbed as adults; pipids, as larvae; pelobatids lack free ossified ribs but have other primitive characters. These four families, although not directly related, probably represent stages in the evolution of higher frogs. Their distributions are somewhat correlated with their places on the evolutionary scale.

The hypothetical history begins in the Cretaceous, with salamanders in the north temperate zone, caecilians in the tropics, and frogs principally in the tropics of the Old World. Later changes chiefly involved the frogs. What is said here about the movements of frog families will be best understood if reference is made to the descriptions of present distributions of the families, above (p. 17).

Probably during the Cretaceous, members of the primitive Ascaphidae, once present in the tropics, at least in the Old World, withdrew into the temperate zones. Probably also in the Cretaceous, members of the aquatic Pipidae got from the Old World tropics to South America in company with fresh-water fishes. If the fishes filtered through the north temperate zone, so may have the pipids, and so too may have caecilians. Perhaps later, the Discoglossidae withdrew from the Old World tropics into temperate Eurasia, leaving a rearguard in the Philippines. And the Pelobatidae may now be withdrawing northwards from the Old World tropics.

Most higher frog families (according to my hypothesis) have originated in the Old World tropics, have dispersed from there, and in the case of the older families have begun their extinction there with the rise of later groups, mostly during the Tertiary. Leptodactylids, now surviving in South Africa and the Australian and tropical American regions, are pointedly fossil in the Eocene of India. *Hyla* and the Hylidae fit this pattern as they do no other, assuming that South America has been a secondary center of their evolution. The Atelopodidae, apparently relict in the Orient but numerous in tropical America, may fit the pattern but are poorly known. Brevicipitids are in a less advanced stage of the cycle. Although still numerous in parts of the Old World tropics, they have broken into retreating or isolated subfamilies. They show clearly how an Old World tropical family can filter through the north temperate zone to the New World tropics. The Bufonidae, Ranidae, and Rhacophoridae now dominate all frog habitats in the main Old World tropics; and two genera of them, both notably cold-tolerant, have spread apparently recently over most of the rest of the available world.

This hypothesis stresses for amphibians the same factors that were stressed previously for fresh-water fishes: climate, competition, the Old World tropics as a center of evolution and dispersal and of extinction, and the north temperate zone as a filter bridge for tropical groups. The parallel between distributions and apparent histories of amphibians and of fresh-water fishes is striking, allowing for their obvious differences of habitat and means of dispersal. Caecilians and salamanders, like non-ostariophysan primary-division fishes, are mostly zoned with climate, the one group in the tropics, the other in the north temperate zone. Frogs, like the Ostariophysi, are partly zoned, but some of them, like the Cyprinidae among the Ostariophysi, have radiated apparently from the Old World tropics over much of the rest of the world. That this parallel is real and not just a matter of parallel hypotheses will, I think, be granted by anyone who will study the facts presented in preceding pages.

Relict amphibians parallel relict fresh-water fishes. Caecilians and salamanders must be ancient, but they include no uniquely archaic species in isolated places. These orders survive chiefly

in the main continental tropics and in the north temperate zone respectively. The Ascaphidae, Discoglossidae, Pipidae, and Pelobatidae are phylogenetic relicts among frogs, but only one genus of them, *Liopelma* of New Zealand, is geographically isolated. It is comparable to the lungfish in Australia. Other relict frogs, like relict fresh-water fishes, are about evenly divided between the full tropics and the north temperate zone: the tropical Orient has certain discoglossids and pelobatids; Africa and South America, pipids; the north temperate zone, an ascaphid, discoglossids, and pelobatids.

REPTILES

Existing reptiles are placed in four orders: the Rhynchocephalia, Crocodilia, Chelonia, and Squamata; and the last is divided into two suborders: the Lacertilia and Serpentes.

Rhynchocephalians were cosmopolitan in the early and middle Mesozoic, but are not known fossil above the Lower Cretaceous. Nevertheless, one species, *Sphenodon punctatum* Gray, still exists. It is known only from New Zealand, where formerly it was common on both main islands, but now survives chiefly on a few coastal islets. It frequents sandy and rocky places, often by the sea; it likes to lie in water, and swims well; and adults can live for months without food or fresh water. That any rhynchocephalian should exist is astounding, but that such an animal as *Sphenodon* has reached New Zealand is less surprising than that a frog has done so.

Existing crocodilians form one family of 9 genera, 25 species (Schmidt, 1944). They occur in the tropics on all continents and major islands, and locally in the warm edges of both temperate zones. Their present northern limits are set by the two living species of *Alligator*, one in the lower Yangtse Kiang, the other in southeastern United States north to the Carolinas. The family forms three poorly defined groups. Fossils show that all three were present on northern continents in the Eocene, and crocodile and alligator types were common there in the early Tertiary. They were present on southern continents at the same times (Romer, 1945, p. 222).

Recent, non-marine Chelonia, or turtles, form about 10 families, 57 genera, and more than 200 species. They are numerous in the tropics and in parts of the temperate zones. An *Emys* reaches 60°N. in Europe, but no other European turtle reaches even 50°. A *Trionyx* is common in the Middle Amur at about 50°, but no other Asiatic turtle occurs north of about 40°, and a great part of interior and northern Asia is without turtles. In America, the most northern turtle, a *Chrysemys*, reaches about 51° in British Columbia and Manitoba, 49° or 50° above Lake Superior, and perhaps only 47° farther east. Southwards, turtles reach the tip of Africa, southern Australia but not Tasmania, and northern Argentina in South America. Within these limits they occur on all continents, most continental islands, and some not too remote oceanic islands, but not on New Zealand. (Marine turtles are disregarded in this discussion.)

North temperate turtles include a few peculiar genera: *Clemmys*, with 2 species around the Mediterranean (one of them recorded also from Senegambia, perhaps in error), 5 in eastern Asia (south to Hainan), one on the west coast of North America, and 3 in eastern North America; *Emys*, with one species in Europe and the Mediterranean region and one in eastern North America; and 3 or 4 other genera confined to eastern North America. But other genera and all families of north temperate turtles occur also in the tropics.

Fresh-water turtle families are distributed as follows: Emydids, "common turtles," are numerous in the Orient (17 genera, 38 species, mostly in the eastern Oriental *tropics*) and in *temperate* eastern North America (9 genera, 29 species), and a few occur elsewhere around the north temperate zone, and in Central and South America and some of the West Indies. Side-neck turtles, the Pelomedusidae and Chelyidae, are in Africa south of the Sahara and in the Australian Region (places where emydids are probably absent) and in South America (where emydids are few and probably recent). Pelomedusids actually occur only in Africa (including Madagascar, etc.) and South America; chelyids, in South America and Australia. The pelomedusid genus *Podocnemis* now exists only in Madagascar (one species) and South America (about 6 species), but is fossil in Africa in the Pleistocene and occurred on all continents except Australia at the beginning of the Tertiary. The trionychids, soft-shelled turtles, are in Africa with the side-neck pelomedusids and in the Oriental tropics with emydids; and *Trionyx* occurs also up the east coast of Asia to the Amur and in eastern North America. The single surviving species of the related Carettochelyidae is confined to New Guinea. The chelydrids and kinosternids, the snapping-

and musk-turtles respectively, are in eastern North America, Central America, and parts of northern South America. The two remaining families of fresh-water turtles, each with one existing species, are the Platysternidae in the tropical Orient and the Dermatemydidae in Central America.

Turtles have left a comparatively good fossil record. They appeared in the Triassic. Some existing fresh-water families were wide-spread in the Cretaceous. I can add nothing to what Simpson (1943) has recently said about their early distribution. During the Tertiary, two principal events occurred among them. First, side-neck turtles, which were cosmopolitan at the beginning of the Tertiary, withdrew from the north temperate zone and from the Oriental Region, and some other fresh-water turtles made extensive withdrawals from the same regions (cf. Simpson, op. cit.). Second, the Emydidae, whose members are fossil probably only within the present range of the family and only in the Tertiary, evolved and dispersed in just those areas from which other turtles withdrew. Two clues suggest that the emydids originated in the tropical Orient and spread to a secondary center of evolution in temperate eastern North America. They show much generic endemism in the Orient, less in North America, none in tropical America. And the American forms are concentrated in the cooler climate, as if their ancestors had filtered across a cool land bridge.

Recent terrestrial turtles, excepting a few aberrant emydids, belong to the Testudinidae. The principal genus, *Testudo*, occurs in the tropical and warm temperate areas of all continents except Australia. Giant species of *Testudo* now exist, or have existed within historic times, also on Aldabra, the Seychelles, Réunion, Mauritius, and Rodriguez Islands in the western Indian Ocean, and on the Galapagos Islands west of South America, and one was on Cuba in the Pleistocene. Some of these islands are oceanic. To reach the more remote of them, *Testudo* probably crossed ocean gaps of more than 500 miles.

Extinct, terrestrial, giant, horned turtles of the family Meiolaniidae (Simpson, 1938) lived in southern South America at the beginning of the Tertiary, and on eastern Australia, Lord Howe Island, and Walpole Island southeast of New Caledonia, in the Pleistocene, but are not known to have existed anywhere else. Lord Howe and Walpole Islands are beyond the limits of all other flightless terrestrial vertebrates except lizards; the presence of the turtles there indicates that they could cross ocean gaps. Matthew (1915, p. 283; 1939, pp. 113–114) has suggested that, in some warm period, they spread across an Antarctic archipelago as *Testudo* has spread across the islands of the western Indian Ocean, and this is still probably the best guess to account for their unique distribution.

The Lacertilia, or suborder of lizards, forms about 21 existing families (Camp, 1923), more than 300 genera, and nearly 3,000 recognized species. Lizards occur on the suitable parts of all continents and most islands. They swarm in the tropics, but some range far into the temperate zones. The northernmost lizard, *Lacerta vivipara* Jacquin, reaches 70°N. (well above the Arctic Circle) in Scandinavia, and at least 64° in western Siberia and 53° on the east coast of Siberia. It is the only viviparous (or, strictly, ovoviviparous) species of the family Lacertidae. Second among northern lizards is the related but oviparous *Lacerta agilis* L., which reaches 61°N. in Europe. In western North America, three lizards of three different families reach about 51°N. in southern British Columbia; two are viviparous; one, oviparous. In eastern North America, oviparous *Eumeces fasciatus* (L.) ranges farthest north, but reaches only 46° or 47° in the Great Lakes region and only slightly above 42° on the Atlantic coastal plain. Southwards, many lizards reach the tip of Africa; some, Tasmania; geckos and skinks, both islands of New Zealand; and one genus of the Iguanidae, Tierra del Fuego below South America. New Zealand geckos are the only viviparous Gekkonidae, but New Zealand skinks lay eggs. I do not know the habits of other southernmost lizards.

North temperate lizards are not very different from tropical ones. All widely distributed northern forms belong to families that are also tropical, and many belong to tropical genera. *Lacerta*, for example, ranges from the Arctic to tropical Africa. The only exclusively north temperate lizard family may be the Anniellidae, with one genus, 2 species, confined to the southern half of California and northern Lower California; it is obviously a localized rather than a characteristically temperate group. Some genera of other families are confined to parts of temperate Eurasia or temperate North America, but every genus common to both occurs also somewhere in the tropics. The nearest to a truly Holarctic lizard

genus is probably the anguid *Ophisaurus*, with one species in the Balkans, southwestern Asia, and temperate North Africa; possibly an additional endemic species in North Africa; two or three in the eastern Himalayas, Burma, southern China, and Formosa; one in eastern North America; *and one in the mountains of Borneo.* The old Bornean record is confirmed by a fresh specimen from Mt. Kinabalu in the Museum of Comparative Zoölogy.

The distribution of lizard families, so far as it can be stated in a few words, is this: The great families Gekkonidae and Scincidae are tropicopolitan and range for varying distances into both north and south temperate zones. The Iguanidae and the Agamidae are mutually related and complementary: the Iguanidae, with two relict genera on Madagascar and one on Fiji, is numerous throughout the Americas; the Agamidae is numerous on all Old World continents, but does not extend to Madagascar, nor to Fiji, nor to America. The Lacertidae, numerous through Africa and Eurasia, and the Teidae, numerous through the Americas, are mutually related. Members of the Anguidae are scattered in the north temperate zone of the Old World and in the tropical Orient, and are widely distributed in temperate and tropical America. Amphisbaenids occur in Africa north to Spain and southwestern Asia, and in tropical America north to Lower California and Florida. Varanids occur through the Old World in the tropics and some warm temperate areas, excepting Madagascar but including Australia. Chamaeleontids are numerous in Africa and Madagascar, and outlying species reach the Seychelles, southern Spain, the southeastern Mediterranean, southern Arabia, Socotra Island, and peninsular India and Ceylon. The Gerrhosauridae is found in Africa and Madagascar; the Cordylidae (Zonuridae), only in Africa. The Pygopodidae, with some 8 genera, 14 species, is the only lizard family confined to the Australian Region. It is not an especially archaic family. The remaining families are all small and localized: the Feyliniidae, Dibamidae, and Anelytropsidae are degenerate, skink-like lizards of West and South Africa, Indo-China to New Guinea, and southern Mexico respectively; the Shinisauridae is known only in South China; the Anniellidae, in Southern and adjacent Lower California; the Helodermatidae, in southwestern United States, Mexico, and Borneo; the Xantusiidae, from southwestern United States to Panama, and in Cuba; and the Xenosauridae, in Guatemala and southern Mexico.

Lizards have existed since the Jurassic, but their fossil record is poor. The Gekkonidae, the most numerous and perhaps the most archaic of existing lizards, are unknown fossil. Fossil scincids are few and unsatisfactory. Members of the "Iguania" (Iguanidae + Agamidae + Chamaeleontidae) are fossil in Europe, Asia, and North America back to the Upper Cretaceous, but their earlier remains are not surely assignable to families (Camp, 1923, pp. 307–312). Lacertids have been in Europe since the Eocene, but the record of an African genus, *Nucras*, in Baltic amber may be false; there is reason to think that the supposed fossil is really an existing African species embedded in modern East African copal (Loveridge, 1942, pp. 338–340). The Amphisbaenidae, which does not now range north of Spain and Florida, occurred in the early Tertiary in North America north to Wyoming and South Dakota, and apparently also in Mongolia (Gilmore, 1943). Varanids, now confined to the Old World, are in the Upper Cretaceous and Eocene of North America as well as of Eurasia, and *Varanus* was in Europe, a little northwest of its present range, through much of the Tertiary. Anguids were in Europe, Asia, and North America in the late Cretaceous and early Tertiary; forms close to *Ophisaurus* have been in Europe since the middle Tertiary. *Heloderma* occurred north to Colorado in the Oligocene. This brief list of facts is derived chiefly from Camp's (1923) cautious summaries. Obviously, some lizards have withdrawn from some parts of the north temperate zone during the Tertiary. In only one case can much more be said: the Iguanidae was probably once cosmopolitan, and the Agamidae has apparently been derived from it and replaced it on Old World continents; but this fragment of history is derived more from the distribution of existing forms than from any fossil.

The Serpentes, or snakes, form only about 11 families, but in genera (about 300) and species (about 2,600) they are almost as numerous as lizards. They occur on all habitable continents, most close-lying islands, and a few not too isolated oceanic islands, including the Mauritius group and the Galapagos, but not New Zealand. The majority are tropical, but they are common enough in the temperate zones. In the Old World, *Vipera berus* (L.), which is viviparous, just enters the Arctic, reaching 67°N. in Scandinavia; it or its repre-

sentatives reach 64°N. in Russia, 60° in Siberia, and 55° on the east coast of Siberia; it is the most northern snake. *Natrix natrix* (L.), which is oviparous, is a close second, reaching 65°N. in Scandinavia. In North America, viviparous garter snakes, *Thamnophis*, reach at least 56°N. in British Columbia and 52° in the east. Other snakes, including both viviparous and oviparous forms, reach only about 51° in British Columbia, and probably not that in the east. Southwards, snakes are numerous to the tip of Africa; three elapids reach Tasmania; Schmidt (in letter) thinks the southern limit in South America is probably set in Santa Cruz Province, southern Argentina, by *Trimeresurus ammodytoides* Leybold, a probably viviparous viper.

The north temperate snake fauna is poorly defined. All northern snakes belong to tropical families; many, to tropical genera. *Vipera*, which includes the northernmost snake, occurs also through the tropics of Africa and Asia. There is probably no truly Holarctic snake genus. Some genera are confined to parts of temperate Eurasia or temperate North America, but every well defined genus that occurs in both occurs also somewhere in the tropics. Schmidt (1946) cites *Opheodryas* as confined to eastern Asia and eastern North America, as it is, but there are more species of the genus in the tropics of northern Indo-China than in any temperate area. *Coluber* in a very strict sense (Inger & Clark, 1943) is confined to temperate North America and northeastern Asia, but it is a weakly defined genus; it is perhaps a minor group which has recently crossed a Bering land bridge rather than a genus peculiarly adapted to north temperate climates.

The families of snakes are distributed as follows: the Typhlopidae, burrowing "blind snakes," are tropicopolitan and occur also in some warm temperate areas. A second family of "blind snakes," the Leptotyphlopidae, is confined to Africa and southwest Asia and tropical and warm temperate America. The burrowing Uropeltidae, with 7 genera, 43 species, is confined to peninsular India and Ceylon. The Anilidae consists of one small genus in the Oriental tropics and another in South America. The monotypic Xenopeltidae is Oriental. The Boidae, including the giant constricting snakes, forms two subfamilies. The Boinae is represented on Old World continents by only terrestrial, more or less burrowing *Eryx*, which ranges across temperate Asia into North and tropical East Africa; but two monotypic genera occur on Madagascar; two more, on Round Island off Mauritius; and *Enygrus* inhabits New Guinea and other islands in the eastern Indo-Australian Archipelago, and east to Fiji and Samoa. In America, one terrestrial genus of the Boinae occurs through western United States north to southern British Columbia, and another is confined to California and neighboring areas; but the subfamily is best developed in South and Central America and the West Indies. The Pythoninae occurs in the tropics and some warm temperate regions of all Old World continents and major islands excepting Madagascar, but including Australia; and one endemic genus is in Central America. Note that, in the Old World, the only place where boas occur in open competition with pythons is on New Guinea and neighboring islands. The egg-eating Dasypeltidae has one genus and species in India, another in Africa. The Colubridae, which includes about two-thirds of all snakes, is a nearly cosmopolitan family but has few members in northern and eastern Australia and none in southern and western Australia. Two subfamilies of colubrids, the Acrochordinae and Homalopsinae, with together 12 genera, about 30 species, are fully aquatic; they inhabit fresh and salt water from the Orient to northern Australia. The Elapidae, including cobras, coral snakes, etc., occurs throughout the tropical and some warm temperate regions of the world, but is most numerous in Australia. Most of the Australian species are small and inoffensive; they are poisonous snakes, but they correspond in habitat and behavior to the harmless Colubridae which dominate the rest of the world. The Hydrophiidae, sea snakes, are numerous from the Orient to northern Australia; one species reaches the east coast of Africa, and one (the same one), the west coast of America; there is none in the Atlantic. The Viperidae forms two subfamilies: the Viperinae, or typical vipers, of Africa and Eurasia; and the Crotalinae, or pit vipers, of eastern Europe, Asia, and the Americas. Both subfamilies occur in tropical as well as temperate Asia and on parts of the Indo-Australian Archipelago.

Fossil snakes appear in the Cretaceous. Boids were very widely distributed in the late Cretaceous and Eocene. Colubrids are unknown until the Oligocene, and the few fossils are not important geographically. Elapids are known, before the Pleistocene, only by *Palaeonaja* in the Miocene and Pliocene of France; elapids no longer occur in

Europe. Viperids appear in the Miocene. *Bitis*, a genus of vipers now confined to Africa and Arabia, is recorded from Europe in the Pliocene. Most other snake families are unknown in a fossil state. This scanty record reveals little of the geographical history of snakes, and only a little more can be deduced from their present distribution. Among the Boidae, the Boinae were probably once cosmopolitan, and the Pythoninae are probably derived from them and have nearly replaced them on Old World continents. This is, I think, suggested by the distributions of both fossil and living forms. The boas are retreating toward Madagascar and Fiji just as iguanid lizards have done.

It is a curious fact that all families and almost all subfamilies of snakes occur in the Oriental Region, although some just enter its edge (Smith, 1943). The Orient has been a crossroads in the dispersal of snakes, if not a chief center of their evolution. The principal groups of aquatic snakes, both fresh-water and marine, are all in or around the Oriental Region, which has probably been their place of origin.

HYPOTHETICAL HISTORY OF DISPERSAL OF REPTILES

There is no distinct, generally distributed, exclusively north temperate reptile fauna. Characteristic northern reptiles all belong to tropical families; many, to tropical genera. Apparently reptiles have not often become thoroughly adapted to temperate climates, nor have they persisted and evolved in them over long periods of time. Fossils show that some existing tropical reptiles were once widely distributed in the north, but where the record is good, as among crocodilians and some turtles, it appears that the old groups were really more or less cosmopolitan rather than northern. It looks as if reptiles have evolved chiefly in the tropics, and as if various tropical groups have spread into the north temperate zone, and have sometimes died out there later. Only rarely is it possible to trace the history of single families within this main pattern. Emydid turtles probably arose in the Oriental tropics during the Tertiary, and their radiation in the Orient and the north temperate zone is significantly correlated with the withdrawal of some other turtles, especially the sidenecks. The iguanid-agamid lizards and the boid snakes seem each to have been a cosmopolitan group in which a new family or subfamily has arisen on Old World continents and completely or nearly replaced the original stock there. The principal existing groups of aquatic snakes apparently originated in the Oriental tropics during the Tertiary. I see no profit in guessing here about other families. So far as the evidence goes, the Old World tropics may have been the main center of evolution and dispersal of the great families of existing reptiles, if there has been any main center, but the evidence is much less than in the cases of the ostariophysan fresh-water fishes and the frogs.

Sphenodon, the only surviving rhynchocephalian, isolated on New Zealand, is a phylogenetic and geographical relict. No uniquely archaic species exist in other reptile orders. Turtles as a group are relict; they have existed practically unchanged since the Triassic; they are most diverse in the tropics. Crocodilians too are a relict group; they date from the late Triassic, and are the only surviving archosaurians. They are all in or near the tropics. Note that Australia has *not* been a refuge for archaic reptiles and amphibians. The continent does lack some recently dominant families, but it has no peculiarly primitive reptiles and none of the four most primitive families of frogs.

(*To be concluded*)

SCHOOLING BEHAVIOR IN FISHES

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INTRODUCTION

AN OFTEN observed but still little understood phenomenon in the social behavior of fishes is the school. This may range from a chance grouping of individuals brought into a given locality by some external factor or factors not concerned with relationships between individuals, to a closely-knit cohesive group, in which there appears to be a definite centripetal influence existing between fish and fish. In this review, groups of the former type will be designated as aggregations, those of the latter type as schools.

In connection with the school, a number of questions, as yet largely unanswered, have arisen. For example, one wonders as to the nature of the attractive forces that must exist between fish and fish to lead to the formation of schools. What factors operate to produce a school, to maintain it as a unit, or to disrupt it? What is the value or function, if any, of the school in contrast to a solitary mode of life? Parr (1937) has suggested that "self-recognition" and the ability of a fish to "recognize" others as similar to itself cannot be involved in the schooling behavior of such fishes as the mackerel, and postulated that the reaction is based upon an "automatic mechanism of association." Breder and Nigrelli (1935) have attempted to explain the phenomenon upon a mechanical basis, not involving problems of recognition. The problems to be faced are those of defining the adequate stimuli (Lashley, 1938) and of determining the physiological factors involved in the schooling response.

Parr (1927) was the first of modern investigators to attempt an analysis of schooling behavior in fishes. Previous to his publication, there existed an almost total blank of fifty years, at the beginning of which Newman (1876) had quoted Kent's report that schools of herring in aquaria broke up at night but re-formed with daylight. At that time it was suggested that the schools broke up because of a nocturnal feeding instinct which dominated the schooling instinct.

Parr classified aggregations as occasional and permanent, devoting his analysis to the latter. He showed that these permanent schools are characterized by a high degree of stability and independence from external influences, indicating the existence of dominating factors within the school and/or the individuals which compose it. This view is supported by the facts that, among schooling fishes, newly-hatched individuals will school immediately, before they can possibly have learned that schooling is in any way advantageous; and that two individuals are sufficient to form a school, suggesting a reaction of individual rather than of mass attraction. Further indication of the stability of schools is provided by the results of Merriman's (1941) tagging experiments on the striped bass (*Roccus saxatilis*). In several instances, two or three fish which had been tagged in a single seine haul were recaptured at the same time and in the same area at some distance from the original point of release.

THE SENSORY BASIS OF SCHOOLING

Vision

The prime physical factor in the formation and maintenance of fish schools is vision. This has been amply demonstrated by Bowen (1931, 1932), Breder (1929, 1942), Breder and Gresser (1941a, b), Breder and Nigrelli (1935), Parr (1927, 1931), Schlaifer (1938, 1939, 1940), Spooner (1931), and others. Parr, in his initial analysis (1927), showed upon both theoretical and experimental grounds that this must be the case. In common with the writers cited above, he was able to demonstrate that when vision is eliminated, by removing or covering the eyes, the schooling reaction ceases immediately. Furthermore, schooling ceases in normal fishes during the hours of darkness, or when the amount of light falls below a certain threshold value.

The formation of a school seems to depend upon the attraction which other fish exert upon the individual. Fish tend to remain parallel to and

at a given distance from their fellows. It is supposed that maintenance of this distance is brought about by a balancing of visual stimuli from each side. Thus, a fish between two others need make no adjustment of distance as long as it perceives its companions with equal intensity. On the other hand, a fish on the extreme outside of a group would be unable to balance its visual stimuli in this way, and would be expected to push constantly toward the center. This would undoubtedly aid in preserving the integrity of the school. Since a certain minimal distance is always maintained between fish, it may be that close approach gives rise to antagonistic stimuli, or somehow weakens the tendency to approach, so that finally a balance is attained.

After observing the behavior of schools of *Jenkinsia*, Breder (1929) concluded that approach was made only to that distance at which an object became clearly visible. Thus, there would be a tendency to maintain a certain "comfortable" retinal effect, which would be reached by close approach to objects of small size and by a more distant approach to larger objects. Unfortunately, there seem to be no published studies of piscine optics, so we do not really know even the theoretical limits of clear vision in fishes.

Spooner (1931), experimenting with *Morone labrax*, produced further evidence of the importance of vision in schooling. He found that fish would school in a typical manner with their own reflections in a glass mirror. This experiment has been repeated, with similar results, by other investigators.

A peculiar manifestation of the schooling phenomenon is the "mill," a circular movement of the individuals within a school, while the school as a whole remains relatively stationary. Both in the natural environment and in aquaria, mills may be formed when a school makes a sharp turn of more than 180°. Parr (1927) explained this by assuming that fish passing each other in opposite directions exert stronger visual stimuli than do their companions travelling in the same direction, since the latter are, with respect to a given individual, nearly stationary. Hence, the fish on the inside of the turn tend to incline toward each other. Their companions on the outside, in order to preserve the visual pattern, follow them, and soon the whole school is circling.

One of the peculiarities of the school, as contrasted with the aggregation, lies in the fact that all its members are oriented in the same direction. What is the basis of this phenomenon? An examination of the manner in which fishes orient themselves with respect to their environment is in order.

The results of all students indicate that vision is the most important element in orientation, with touch probably ranking second (Lyon, 1905; Dykgraaf, 1933). Fishes possessing sight tend to maintain a constant visual field, while blind individuals remain unoriented unless in contact with a solid object. Other receptor organs, such as the ear canals, lateral line, etc., may function, but are probably of little importance here (Reinhardt, 1935; Breder and Harris, 1936).

In a current, fishes always tend to head upstream. This is obviously a means of conserving energy. Because of the jet-propulsion effect of respiratory movements (Breder, 1926), a resting fish in quiet water tends to move forward, or must "back water" with its paired fins. Facing into a current of appropriate strength obviates the necessity of expending extra energy to remain in one place.

It has been suggested by Breder and Nigrelli (1935) that many, if not all, schools of fishes are of a mechanical rather than a social nature. In other words, fish group together because other fish provide a reference point on which to "take bearings," rather than because of any desire or urge for companionship, etc. In the case of a school formed in a current, the individuals will tend to choose that strength of current in which position can be maintained with least effort. Obviously, some sort of marker must be involved in sustaining such an equilibrium.

It has also been suggested that the same factors operate in pelagic schools, with the difference that the fish themselves produce the current. But in this case it is difficult to see how orientation with respect to current can be involved. It seems much more reasonable to suggest that only the marker or reference point is involved. This is almost certainly true in the "mill."

Under such an interpretation, the apparent expression of social behavior represented by the school can be considered, as is pointed out by Parr (1927), merely as an incidental result of the mechanically integrated reactions of individuals. This point of view allows some hope of an eventual understanding of the phenomenon, but if schooling be considered as a "social instinct," both it and its inhibition become practically impossible of explanation.

Vision as a stimulus can be broken down into several components—color, form, size, movement, etc. The influence of each, either alone or in combination with other components, may be of importance in relation to schooling. In the following sections, consideration will be given to some of the work that has been done on these aspects of vision.

Color Vision

A great deal of investigation was done on this subject during the early 1900's, chiefly through training fishes to respond to variously colored lights or objects. Most of the early work was open to criticism on the grounds of inadequate control of light intensity, for fishes may be quite sensitive to this. For example, Herter (1929) found that several species of fishes could discriminate between gray 13 and gray 14 of Hering's series. Warner (1931) has made an excellent review of the subject.

More recently, Janzen (1933) found that while reactions by goldfish to intensity, as evidenced by tendencies to seek light or darkness, were lost after extirpation of the forebrain, the ability to make associations with colors remained, suggesting that color was not perceived as a function of light intensity. Other work by Bull (1935) and by Brown (1937) supports this conclusion. Using *Blennius pholis*, Bull found that photopic and scotopic conditions did not produce different results, and concluded that the species tested possessed color vision in the ordinary sense of the term. The fact that these fish did not discriminate between intensity values of the same gray color varying between 20 and 20,000 metercandles is evidence that light intensity was not involved in the responses to color.

Brown (1937) found that red was a distinct color for black bass. In discrimination tests, the bass were able to make sharp demarcations of red and yellow from other colors and from a wide series of grays. They were unable to distinguish between red and purple, nor were they successful with green and blue. The latter colors were often confused with each other and with shades of gray. Where discrimination was observed, color seemed to be perceived as a function of wave-length, but in other cases it is apparent that both intensity and wave-length were factors in producing the responses.

A comparison of human color vision with that of the bass, as indicated by these results, suggests that the fish see very much after the manner of a normal human looking through a yellow filter. This is supported by the fact that Brown found a layer of yellow pigment in the eye of the bass.

Some extraordinarily interesting observations have been made by Noble and Curtis (1939) on color perception and its function in the jewel fish. They found that the young of the jewel fish were attracted to red, and suggested that this attraction was related to the breeding colors of the adults. Females were found to recognize their mates as individuals by means of the color pattern on the head of the male. If the whole body of the male, except the head, were painted over, the female still recognized her mate. However, if certain regions of the face were painted, the rest of the body remaining in its natural color, recognition was prevented. It is to be regretted that the investigation did not include an experiment in which the pattern was kept intact but in a different color from the normal. The results of such an experiment would have given much more nearly conclusive proof or disproof of color recognition. As it stands, all that is shown is the ability to recognize a pattern.

Parent jewel fish were found to distinguish their own young from those of other species by the color of the fry, for staining the young fish led to their rejection by their parents. This appears to be a learned reaction, for when a pair of jewel fish, spawning for the first time, was given the young of a related but differently colored species, they cared for these and attacked their own offspring when the latter were placed in the tank. Fish which had spawned normally one or more times always rejected foreign young. An interesting association between the individual or the species and its color is demonstrated here. Whether discrimination is via wave-length or intensity is not clear. However, the rapidity with which the association seems to be made, coupled with the evidence already discussed, suggests that the more constant factor, wave-length, is the one in operation.

That color is not distinguished in all species of fishes, or else is not a factor in their schooling behavior is suggested by the studies of Schlaifer (1942). He found that a painted mackerel was accepted by its fellows, and suggested that movement, rather than color, was the important factor with these fish. This was supported by the observation that mackerel would not attempt to school with a freshly killed individual. However, the subtle changes in shape and color which occur after death should not be ignored as possible influences in such a case.

Color, then, whether it be perceived as a function of wave-length or of intensity of light, may be considered an active influence in the social behavior

of at least some fishes. On the basis of present evidence, this seems to be particularly true of fishes forming aggregations rather than schools. Schlaifer's work with mackerel may indicate either that color has no influence on the behavior of these fish, or that they are color-blind in the truest sense of the word. In the absence of more conclusive evidence, we must reserve judgment on this particular point.

Influence of Form and Size

Differences in form and size have been shown to be factors influencing aggregative behavior in various fishes. Goldsmith (1914) and Maes (1930) showed that fishes could distinguish different sizes and shapes. Herter (1929) trained his fishes to discriminate between different shapes and between different sizes of similar shapes. Rowley (1934) found that goldfish could differentiate between circles whose diameters differed by as little as 0.3 centimeters. It must be recognized, then, that at least some fishes possess a rather high degree of discriminatory ability in regard to size and shape.

Schlaifer (1940) demonstrated a group effect (lowering of the metabolic rate as shown by oxygen consumption, and reduction of locomotor activity) in goldfish associating with a mounted specimen, but found no group effect when a sunfish model was used. This indicates that either the form or the color was concerned, or possibly both. That the group effect could be produced by the influence of a bleached dead goldfish indicates that the response was to form rather than to color. Later experiments with tarpon (Schlaifer, 1941) showed that a greater number of "imitative" respiratory rises could be induced with relatively life-like models than with objects shaped less like another tarpon. Yet, as Schlaifer has pointed out, even his "life-like" model was but a crude thing when compared to a living specimen. It would seem highly possible that the silvery color of this model had a great deal to do with its success over other objects, perhaps because of being a closer approximation to the natural tarpon color, possibly only because of being more easily seen.

Size, as well as form, may have an attracting or repelling influence on fishes. Breder and Halpern (1946) found that fishes of the genus *Brachydanio* were attracted by small targets outside their aquarium, but were repelled by large ones. This could, perhaps, be related to the size of the experimental specimens. If so, it would be expected that the larger the fish, the larger would be the targets to which they would be attracted or which would repel them. Breder and Coates (1935) observed that male guppies (*Lebistes reticulatus*) would attempt to mate with any retreating object of suitable size.

Further indication of the importance of these factors is given by the fact that schools tend to be made up of individuals of approximately the same size and of the same species (hence, of the same shape). But we can say only that this is so, that these factors have an influence. How they exert their influence is, for the present, a matter of speculation.

Influence of Motion

Schlaifer (1942) noted that normal specimens of the chub mackerel (*Pneumatophorus grex*) would not school with a blind individual. This was apparently due to the slow, atypical manner of swimming of the blind fish, suggesting that the visual stimulus may involve more than just form or color, and may include characteristic motion.

On the other hand, Breder and Gresser (1941a) found that eyed cave fish (*Anoptichthys-Astyanax*) would attempt to school with blind individuals. The eyed animals were unable to keep up with the steady, aimless movements of the blind, leading to "resentment" on the part of the seeing individual and often resulting in its attacking and killing its blind companion. This suggests that the visual stimulus in this case produces an extremely strong reaction, and that atypical movement is not, in these fish, sufficient to inhibit attempts to school. The attack on the blind fish may be considered as a reaction to a deficit (Lashley, 1938).

Tactile Stimuli

Parr (1927) deduced that in catfishes (*Ameiurus* spp.) tactile impressions were chiefly responsible for the schooling activity of the young animals. This was a quite natural deduction, for the young are constantly pushing against each other, and the poor vision and extremely sensitive tactile barbels of these fishes are well known. However, the studies of Bowen (1931, 1932) showed that here again vision is the primary factor, in at least the initial formation of schools. Blinded fish, or those kept in darkness, do not school. On the other hand, it seems quite certain that the mutual pressure produced by individuals pushing toward the center of the group serves to maintain the stability of the school. When the skin of these animals is

anesthetized, their pushing becomes more violent, as though the fish had to push harder to obtain the same degree of tactile stimulation through the now less sensitive skin.

Miss Bowen also found that young catfish would attempt to school with a dead individual held in place with a twig. When a black paraffin model was substituted, the fish would approach the model, play their barbels over it, and turn away. Evidently the visual stimulus initiates the schooling reaction, but tactile stimuli maintain it.

Blinded catfish can detect the presence of nearby companions by means of vibration receptors in the skin, but lacking vision they are unable to remain in contact with an actively moving individual. Dykgraaf (1933) observed a courting response by a blind specimen of *Macropodus viridiauratus*, and ascribed it to the reception by the blind animal of vibratory stimuli from the rapidly moving tail of its partner. He found that, in general, the perception of objects by other than visual means rests chiefly in the lateral line organs. This is in direct contrast to Bowen's results and to those of Parker (1905). Breder and Rasquin (1943) observed schooling tendencies in naturally blind and operated characins which could not have been based on visual stimuli. While they did not determine the receptor organs involved, they suggested the possibility of the lateral line, or of chemical sensory receptors.

The "thigmotactic appetite" of young catfish would appear to be a factor ranking next only to vision in maintaining schools. To a lesser extent this is true also of older catfish. The latter, however, seem able to satisfy their thigmotropism by resting in contact with each other. It may be that in the young animals the thigmotropism is the basic cause for schooling, while vision is the chief means by which it is carried on. This is in contrast to the situation in the Scombridae and Clupeidae, described by Parr and by Breder, wherein schooling seems to be based almost entirely upon the visual pattern.

However, thigmotropisms may be functional, to a lesser degree, in other fishes. Breder and Nigrelli (1938) have found that in goldfish, which exhibit no great degree of thigmotropism and are not especially aggregative, the "desire" to be close to a solid object may be of importance. They suggested that the rapid swimming along the sides of a tank by a solitary goldfish may be an expression of a search for companions, and that the approach to solid objects when in the solitary state is a partial substitute for an approach to companions. In this manner, schooling might be considered as an expression of a thigmotropism.

This phenomenon, if considered as a conscious "desire" to be close to a solid object or companion, at once becomes impossible of further elucidation. Such an interpretation is, therefore, to be avoided. Actions of this sort can be more easily and rationally explained if they are interpreted on a physical basis. Swimming around the sides of a tank could then reduce to an expression of the fact that the environment is sharply limited. That this particular item is not to be analysed so easily is shown by further results of these investigators. Fish placed in a large shallow pan followed a more or less aimless path until they encountered the edge. On a second trial, however, the fish swam in a practically straight path until they reached the edge. Obviously, some sort of thigmotropic reaction is involved, but further analysis of the stimuli involved is necessary before a synthesis of this item of behavior can be made.

If such behavior is considered as a thigmotropism, one can, with equal logic, reverse the premise and interpret the approach to a companion as a substitute for approach to a solid object. In support of this view, it may be pointed out that, in general, schooling is least developed in demersal fishes, which have numerous solid objects readily available in their environment, and most highly developed in pelagic fishes, whose environment characteristically exhibits a dearth of solidity. That fishes such as the clupeids described by Breder (1929) school with each other, rather than with solid objects when the latter are available, may be explained by the assumption that small moving objects exert more intense stimulation than do larger sessile objects.

Chemical Sensitivity

Schooling as part of a "fear" reaction is well known in many species of fishes. This reaction might be simply the result of all the members of a dispersed group fleeing to the safest spot, or to the place best suited for defense, but such an hypothesis is hardly adequate to explain the change from a loose aggregation to a closely-knit, cohesive school. Obviously, under the influence of fear the responses of individuals to each other are altered. Recent work by von Frisch (1938, 1941a, b) and by Göz (1941) indicates that chemical sensitivity may be

involved in this and in other aspects of the schooling phenomenon.

The investigations referred to above showed that a purine- or pterine-like substance (Hüttel, 1941) is released from the skin of the minnow (*Phoxinus laevis*) upon injury, and that the presence of this substance in the water leads to the fear reaction. Since it has also been found that *P. laevis* can discriminate not only between species but also between individuals of the same species upon a chemical sensory basis, it seems quite possible that this is a factor in preserving the unity of a school. It may be suggested that chemical sensitivity would be most important in this respect during darkness, when vision is inoperative.

Influence of the Central Nervous System

Several investigations have been made on the relation of the central nervous system to the social behavior of fishes. Janzen (1933) found that after removal of the forebrain fishes lost "initiative"—the ability to react to external factors. Wiebalck (1937) extirpated the forebrain from *Box salpa* and found that thereafter the operated individuals avoided companions. Noble (1936) found that experimentally produced lesions of the corpus striatum in cichlids resulted in a loss of coordination in breeding behavior. Nearly complete removal of the forebrain inhibited, but did not completely prevent, mating, but such matings were sterile. Sex recognition was not impaired. However, schooling was permanently affected by extirpation of the forebrain. Noble concluded that the forebrain acted to regulate social behavior by coordinating the complex behavior patterns and influencing the pituitary.

EFFECTS OF OTHER ENVIRONMENTAL FACTORS

Many factors of the environment may have pronounced effects on fish aggregations and schools. Breder and Roemhild (1947) described the case of a group of young *Ameiurus nebulosus*, which, when taken from a juvenile school in an outdoor pond and placed in an aquarium, exhibited an almost completely random distribution. While these writers made no report of attempts to analyse the factors producing this startling result, it is mentioned as an indication of the importance of environmental conditions.

Food habits and food supply undoubtedly have a direct bearing on the social behavior of fishes. Langlois (1936a) has reported that cannibalistic juvenile bass in rearing ponds form separate groups, remaining apart from the normal juvenile schools. In all, eight different types of social organization were noted, all derived from similar origins and seemingly correlated with the size and feeding habits of the individuals composing them.

In general, chemicals do not seem to have any great effect on fish schools. However, Langlois (1936b) reported the formation of peculiar vertical schools of bass when the water of the rearing pond became accidentally chlorinated. Precisely what effect chlorine has is obscure.

Carbon dioxide in high concentrations leads to the formation of schools (Breder and Nigrelli, 1935; Breder and Halpern, 1946). Indeed, Breder and Nigrelli found that schools formed in response to this stimulus would re-form immediately, even after mechanical breaking up, as long as the carbon dioxide tension remained high.

Changes in the physical properties of the water, particularly in pH (Noble and Curtis, 1939) and temperature (Breder and Nigrelli, 1935; Breder, 1936; Noble and Curtis, 1939; Breder and Halpern, 1946) are known to produce marked alterations in schooling behavior. Radical changes in pH induce the formation of schools of *Hemichromis*. It may be that the abnormal schools of bass, described by Langlois (1936b), formed in response to a change in pH rather than to direct action of chlorine.

Lowering of temperature results in the formation of schools, both in aquaria and in nature. A number of centrarchids (*Aplites salmoides*, *Lepomis auritis*, *Acantharcus pomotis*, *Pomoxis sparoides*) are known to school under the influence of cold, and probably others do also. In their excellent study on the winter aggregations of the sunfish (*Lepomis auritus*), Breder and Nigrelli (1935) noted that schooling occurred at 5°C., but that, on raising the temperature, the school did not break up until a temperature of 10°C. had been reached. They suggested that this lag was due to "psychic inertia." It seems much more logical to interpret this as indicative of a physiological, rather than a "psychic," threshold. Indeed, all the evidence suggests strongly that there is a close connection between schooling and metabolic rate. Studies of the physiology of fishes would doubtless go far toward disclosing the nature of this relationship. At present, we can say only that decreasing or impeding the normal rate of metabolism seems to be correlated with the formation of schools. Why this should be so is not at all clear. Langlois

(1936b) suggested that "stimulating body contacts cause the opposite reaction and tend to prevent the ultimate loss of life from cold." Before we can accept this suggestion, however, it is necessary to inquire into the nature of the stimulations and reactions produced by "stimulating body contacts."

SOME PHYSIOLOGICAL CONSEQUENCES OF SCHOOLING

It has long been known that animals in groups may exhibit certain physiological differences from solitary individuals. A great deal of work has been done in this field, of which only a few examples will be considered here. Allee (1934) has reviewed the subject.

Schuett (1933, 1934) was one of the first to demonstrate the presence of group effect in fishes, finding that fishes in groups were less active or had lower metabolic rates, as evidenced by oxygen consumption, than solitary animals. These results were confirmed by Schlaifer (1938, 1939), who also reinforced Schuett's suggestion that the relation between the number of fish and the volume of water in which they were contained could have an effect upon the activity of the fish. This is a factor which seems to have been inadequately controlled in studies of this sort.

The work of Escobar, Minahan, and Shaw (1936) also demonstrated the presence of group effect in homotypic (all individuals of the same species) groups. A possible explanation lies in their suggestion that, in groups, the "free path" movement of an individual is obstructed by its companions. Continuous small movements are made, adjusting direction and orientation in relation to nearby companions. By contrast, an isolated fish maintains more prolonged single movements, resulting in greater total activity.

If this is indeed the case, it should be possible to produce group effect with a solitary fish in a complicated maze, one so complex that long single movements would be impossible. But even if this experiment should yield the expected results, it would not explain the observations by Escobar, Minahan, and Shaw (1936), by Schlaifer (1940), and by Schlaifer and Breder (1940) that group effect is not present in heterotypic groups. In some cases, this result might be laid to greater activity on the part of the individuals of the second species, for motion in itself seems to be a stimulus to activity; but in other cases this interpretation cannot be made.

The question of the group effect is filled with apparent contradictions. The evidence presented in this section suggests that aggregation causes a lowering of the metabolic rate. The evidence discussed in the previous section tends to show rather the opposite relation. At the moment we have no means of reconciling these two antagonisms. Visual perception of companions appears to be a factor in producing a group effect (Schlaifer, 1938, 1939), yet Breder and Rasquin (1943) and Schlagel and Breder (1947) found a group effect in blind characins. An adequate analysis of the factors involved is still lacking. Until it is procured, a comprehensive explanation of the phenomenon cannot be made. The manner of perception of companions and the volumetric relationships involved will particularly bear more detailed study.

INFLUENCE OF SEXUAL ACTIVITY

The effect of sex upon schooling is often marked, and the relationships between the tendencies toward sexual behavior and toward schooling behavior are complex. That the young of many species exhibit schooling behavior is well known. This is true, for example, of the Cichlidae and Centrarchidae, wherein not only do the young tend, of themselves, to school, but this impulse is reinforced by parental "herding." That this is indeed the case, rather than that herding by the parents brings about schooling in the young, is indicated by the observations of Noble and Curtis (1939) on *Hemichromis bimaculatus*, to the effect that the young of this species tend to bunch up, although they form more compact groups under the influence of parental guiding. Juvenile schools of various centrarchid fishes have probably been seen by nearly everyone who has wandered along a stream in warm weather. Breder and Halpern (1946) studied aggregating behavior in young *Brachydanio rerio*. These fish are not particularly aggregative until several months old. Breder and Halpern isolated fertilized eggs and raised the young in isolation to an age of several months. On being placed in a tank with a school of young of comparable age, these fish immediately joined the school, indicating the unlearned nature of the reaction. Parr (1931) suggested that the early appearance of the schooling reaction in the life of the individual, and the fairly constant relationships of schooling to systematic groups of fishes, indicate a phylogenetic rather than an ontogenetic origin of the phenomenon.

Young specimens of *Aequidans latifrons* cease their juvenile schooling with the appearance of the adult colors (Breder, 1934). Since this is correlated with the development of the gonads, Breder suggested that a gonadal influence effected the inhibition of schooling. But this need not be interpreted as a direct influence. It is quite possible that pituitary action, itself influenced by the gonads or by visual stimulation from the secondary sex characters, could accomplish the same thing. This would be related only indirectly to gonadal influence. Bowen (1931) and Breder and Roemhild (1947) noted the gradual inhibition of schooling with maturity in young catfish. The latter writers also reported that "sex-starved" guppies showed distinct pairing of males with females, while those not in such a sad condition tended to pair as two males together and two females together. This observation was made on a group of only four fishes. It would be interesting to make similar experiments with larger groups.

Among certain centrarchid fishes a heterosexual, centrifugal influence breaks up the wintering aggregation (Breder, 1936). This becomes stronger as the males move into shallow water, resulting in territoriality. The choice of nesting sites is controlled by three factors: the centrifugal influence among the males, the space available, and the depth of the water. Post-spawning aggregations sometimes occur, but these are never strong until the approach of cold weather.

Parr (1931) has analysed the relationships between sex and schooling. Assuming that non-schooling is the more primitive condition, he states that the sex complex is undoubtedly important in this connection, having its basis, like the school, in the visual perception of other individuals. Further, differential sex attraction tends to break up the uniformity of the school. There will be weak attraction, or even repulsion, among members of the same sex, and a correspondingly stronger attraction among members of opposite sexes. However, to obtain such differential attraction, there must exist some sort of sexual dimorphism. Furthermore, mechanisms of sexual attraction cannot be lost, unless replaced by schooling behavior, without leading to the extermination of the species. Thus, in forms which survive, this mechanism must change from a heterosexual to an ambisexual orientation, resulting in attraction of all individuals of a species for each other, regardless of sex. In this manner, the sex complex may develop into the schooling complex. In general, schooling is not accompanied by conspicuous sexual differences. The Clupeidae and Scombridae, exhibiting the most perfect of schools, show complete lack of external sex differences and spawn in indiscriminate schools, without apparent heterosexual orientation. The monomorphous Haemulidae are a schooling group, but the dimorphous Labridae and Scaridae are not. Among dimorphous fishes, schooling is often common in the young until such time as the animals become sexually mature. The stickleback (*Gasterosteus aculeatus*) normally schools, but with the appearance of dimorphous sex characters in the breeding season the schools disintegrate, only to re-form following the cessation of breeding.

It will be noted that Parr's argument can be carried equally well from the standpoint taken by him (that schooling replaces sexual dimorphism) or from the opposite assumption, that sexual dimorphism replaces schooling. In either case, it develops that one possible function of the school is the insurance of successful reproduction. The widespread habit of schooling during periods of sexual inactivity suggests that the aggregating impulse is of wide distribution among various groups of fishes, while actual schooling depends upon the promoting or suppressing influence of externally perceptible sex differentiation.

FUNCTIONAL ASPECTS OF SCHOOLING

Thus far, some of the factors operating to bring about or to prevent schooling, and some of the results of the phenomenon have been discussed. In this section, note will be taken of some possible functions of the school.

Parr's (1931) theory of the importance of schooling in insuring successful reproduction has already been discussed. Bowen (1931) suggested that the juvenile schools of catfish might be a protective phenomenon. These fish are notoriously poor of eyesight, and it seemed possible to Miss Bowen that the many eyes of the group might compensate for the poor vision of the individuals composing it. If it could be demonstrated that the "fear substance" found by von Frisch in the skin of minnows is released upon visual perception of a fear stimulus, this interpretation of Miss Bowen's would not be as far-fetched as it sounds. In such a case, visual perception of a fear stimulus (e.g., a predator) by one member of the school would lead to release of the "fear substance" and so to flight of the whole school. But even such an interpreta-

tion as this is of doubtful validity, since von Frisch has stated that the "fear substance" requires thirty seconds or more to produce an effect. A time interval of this length would be more than sufficient for any self-respecting predator to wreak considerable damage on a school of small fish.

Allee and Bowen (1932) found that groups of fish were able to neutralize greater amounts of a toxic substance (colloidal silver) in their environment than were single fish in the same volume. This was shown to be a direct mass relationship, since in proportionate volumes there was no significant difference between groups and isolates in the amount of silver removed per fish. Allee and Bowen suggested that the major advantage of the group over the individual in such a situation lay in the greater removal of toxic substance per unit time by the group. Slime and excretory products were found to be the active agents.

Langlois (1936a) described the feeding behavior of young black bass at the time when they begin to take food in large particles. At this time the young fish strike the food particle, grasp it, and swim off with it, away from the rest of the school. This presents a marked contrast to their early behavior when feeding on zooplankton. Then the young fish approach a food particle and engulf it, or suck it into the mouth, but do not exhibit the "grab and retreat" pattern of behavior. It is possible that the later type of behavior might be developed as a corollary to competition provided by the group, and as such might well be expected to have a positive survival value.

It has often been suggested that animals in groups learn more rapidly than when alone. The possible influence of a "trained" animal over an "untrained" one almost invariably leads to the question of imitation. Do animals learn more rapidly when associating with a "trained" individual, or do they not? If so, do they learn through imitating? Little is known about the answers to these questions as far as fishes are concerned. Welty (1934) seems to have been the only person to experiment with fishes in this way. He believed that fishes in groups learn more rapidly than when alone, and also that fishes learn even more rapidly when associated with a fish already trained than when in untrained groups. Group-trained fishes seem to retain their training a little better than those trained singly. Welty felt that imitation is a strong factor in group learning. If such be the case, the survival value of imitation would depend upon the survival value of the pattern imitated. However, as he pointed out, the survival value of the behavior pattern of a surviving, successful species would, of necessity, be high. Welty suggested that the chief value of such imitation would lie in learning parts of the pattern which were not "instinctive." One might wonder just how much of the behavior pattern of fishes is innate and how much is learned, and also how much of the latter portion can be learned by imitation.

It should not be difficult to devise experiments to test for imitative behavior. For example, in a schooling species, if one fish learns a maze, will another one follow the first without error and thereafter perform correctly when alone? A positive answer would suggest the presence of imitative ability. Welty's experiments allowed goldfish to observe a trained fish pass through a hole in a partition and be fed. The curves of results by the visually conditioned fish showed a shorter time, up to about the fifth trial, required for the fish to pass through the hole. However, the shape of the curves is that of typical "trial-and-error learning curves," which would not be expected if imitation were actually in operation. Furthermore, analysis of Welty's data as read from his graphs (no tables were published) shows that the differences in time required by conditioned and unconditioned fish are definitely not significant. We cannot, therefore, accept these results as evidence of imitation, nor can we agree with Breder and Nigrelli (1938) that these results "give a measure of the influence of an individual that 'knows' where it is going over one that does not."

Breder (1934) suggested that the negative phototropism of schools of young *Aequidens latifrons* had a definite survival value in the wild state. Such behavior would lead the young to frequent dark holes on the stream bottoms, where, presumably, they would be less visible and less liable to the attacks of predators. Breder also noticed that, among adults of this species, a high concentration of carbon dioxide led to the formation of stable schools, although at low carbon dioxide levels the adults exhibited rather strong anti-social tendencies. He attempted to ascribe a positive survival value to this behavior in nature, where tropical pools often become dry. Presumably, as the pool dries up and becomes smaller, the carbon dioxide content of the water will rise, causing schooling behavior to dominate anti-social fight-

ing and enabling the group to live harmoniously in a restricted space. It might also be that schooling would produce a group effect, with lowered oxygen consumption. Still, this seems a tenuous argument, for even though these effects were present in each individual, the concentration of individuals might be expected to result in an increase in total metabolism per unit volume within which the fish were concentrated, and hence a more rapid depletion of the available oxygen and more rapid suffocation of the individuals occupying the space. In considering the possible value of schooling under abnormal conditions, it is well to recall the statement of Breder and Nigrelli (1935) that such schools or aggregations may be useful, neutral, or even harmful to the individual or to the species, or to both.

CONCLUSION

The premise of visual reference points proposed by Breder and Nigrelli (1935) is probably the true explanation of the most basic factor in the formation of schools. But when we consider, for example, the species-specific schools of certain pelagic fishes, or the apparent "preferences" of various species for particular shapes, colors, types of movement, etc., it becomes obvious that our knowledge of the stimuli producing the schooling response is inadequate. The same is true of such phenomena as group effect. More factors are involved than a simple reference point by which a fish can hold its position. Adequate analyses of the stimuli and of their actions are needed, for as yet we are but poorly aware of the influences affecting these phenomena.

It is quite possible that further studies of the relationships between endocrine activity and behavioral phenomena will lead to an adequate explanation of some of these observations. The mathematical approach to the problem of distribution in space taken by Breder and his co-workers seems a promising line of attack and should lead to useful general propositions. But it must always be recognized that many factors influence the schooling reaction and that these factors may, and undoubtedly do, act in different ways in different species of fishes. "Instincts," "tropisms," and "desires" as causal factors can lead but to blank walls. Only well controlled investigations, aimed at the mechanisms involved and accompanied by careful integration of the results, can ever hope to reach an adequate solution of the problem.

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NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will occasionally appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to H. B. Glass, Assistant Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

SEXUAL BEHAVIOR IN THE HUMAN MALE, WHITE, U. S. A.

A review of *Sexual Behavior in the Human Male*, by *Alfred C. Kinsey, Wardell B. Pomeroy, and Clyde E. Martin*, of Indiana University. Published by W. B. Saunders Company, Philadelphia & London. $6.50. xvi + 804 pp.; graphs and figures. 1948.

By Bentley Glass, The Johns Hopkins University

Great scientific books are of two chief sorts. The more frequent kind is that which surveys an active field of science, summarizes the work of perhaps hundreds of scientific lives, and with masterly grasp achieves a synthesis of scattered and ill assimilated materials. Such were Wilson's *The Cell* and Bayliss' *General Physiology*, and, in more recent years, Dobzhansky's *Genetics and the Origin of Species*.

But once in a great while a book comes along which marks the commencement, not the climax or end, of a scientific era. These are the books that virtually begin a new science, that blaze a trail into the unknown. Such a book is *Sexual Behavior in the Human Male*. Heretofore our knowledge of human sexual behavior has been gleaned casually, from chance communicants and from patients with neuroses and sexual problems of one sort or another. As the authors point out, "there are, of course, thousands of individual case histories . . . in the writings of Havelock Ellis, Freud, Stekel, Hirschfeld . . . and a long list of others. In many ways these have been important contributions on sex. . . . But none of the authors of the older studies, in spite of their keen insight into the meanings of certain things, ever had any precise or even an approximate knowledge of what average people do sexually. . . . They never knew what things were common and what were rare, because their data came from the miscellaneous and usually unrepresentative persons who came to their clinics (Freud, Hirschfeld, et al.), or from persons from whom they happened to receive correspondence (Ellis), or from limited numbers of persons whom they interviewed in elaborate detail (as in the Henry study)." The authors reiterate that a clinic is the very last place to choose to learn about normal sex behavior, for only the maladjusted are to be found there. There have been, of course, a variety of statistical studies prior to this one, but none of enough scope to be reliable. Kinsey and his colleagues have found that "about 300 cases are desirable for a sample in a group that is homogeneous for sex, age, educational level, and the various other factors. . . . Only five of the studies [previously published] were restricted to populations which were homogeneous for three or more of the factors listed above."

To what extent, then, and in what ways has the work of this group succeeded where previous efforts failed. First of all, in the scope of the project, which far exceeds that of any earlier work. Kinsey, a student of variation in gall-wasps, began with the recognition that only a study of large series of individuals and of adequate samples of groups could possibly lead to reliable conclusions. Only the funds generously provided by the Rockefeller Foundation have made so extensive a study possible. 12,000 histories, laboriously gathered in the course of nine years, have been drawn from every state in the Union (but principally from the northeastern quarter of the country), from people aged 5 to 90 years, and from every stratum of American society—rural and urban; the levels of grade school education, high school, college, and post-graduate training; laborers, inmates of penal institutions, members of the underworld, prostitutes, clerks, farmers, business men, college students and professors, clergymen, etc. In the present volume, the 5,300 white males of the sample are analysed. Approximately one-half of these are college-bred, so that one may readily see that no effort was made to sample all strata of the population equally. The Negro

males have not furnished a large enough sample for analysis at the present time.

The real heart of the study is to be found in a sequence of chapters (2–4) that most readers will probably skip. These chapters deal with Interviewing, with the Statistical Problems, and with the Validity of the Data. These are vital because the success of such a study inheres in the nature of the methods that were used. Modern sampling techniques were chosen: approximately equal samples, up to a size of 300, were sought from each of the ultimate groups, in order to minimize sampling errors, and the total U. S. population was then reconstructed by multiplying each group by its respective proportion of the entire population. Attention was given to the proper diversification of each sample. Samples where one hundred per cent of the group submitted histories were sought and compared with partial samples of similar groups, the results being found to check closely.

In gathering the data, the use of questionnaires was discarded as unreliable, and all data were secured by personal interviews by one or another of the three trained investigators. Strict confidence regarding the identity of histories has been maintained by almost fantastic precautions of coding and safekeeping. A basic minimum of about 300 items was systematically covered in each history-taking. Rapid, direct questions helped to lessen lying or subterfuge, but getting the confidence of the subject was equally important. Such comments may convey a minimal idea of the procedure, but the chapter will have to be read in its entirety to be appreciated. It was no overstatement the authors made in remarking that "the development of an interviewer is a long and slow process . . . a full year of training. . . ."

Everything hinges upon the Validity of the Data in such a study as this. Can the conclusions be believed? It would be better never to read them if the data on which they are based are false. One point must therefore never be forgotten, in the present instance. The data here are not actually items of sexual behavior—the data themselves are the reported histories of sexual activities. The real behavior is only to be seen through the glass of memory, beclouded by conscious and subconscious motives for concealment and falsification. But lying can be detected by questions that cross-check one another. Falsification can be detected by checking the independently taken histories of husbands and wives, etc. The constancy of memory can be validated by re-takes of histories after a lapse of 18 months or more. The results obtained by one interviewer can be compared with those obtained by another on a similar group. In all these respects the data show remarkable consistency and reveal a high order of validity. The conclusion one is entitled to make, therefore, is that the histories of sexual behavior are statistically reliable data. As histories, they represent probably a minimum rather than a maximum relation to the real behavior, for the fading of memory and the predominance of motives for concealment over those for exaggeration would both work to reduce reported sexual activities below the real.

The data are analysed to throw light on early sexual development; on the total sexual outlet, comprising (1) coitus,—premarital, marital, and extramarital, (2) masturbation, (3) nocturnal emissions, (4) heterosexual petting, (5) homosexual relations, and (6) animal contacts; on intercourse with prostitutes and female companions; on the relation to sexual outlet of age, marital status, age of adolescence, social level, rural-urban background, and religous background; and on the stability of sexual patterns. Some of the major findings and conclusions may be briefly summarized:

(1) Pre-adolescent sex play, more homosexual than heterosexual, rises to an incidence of 38.8 per cent at age 12.

(2) Orgasm has been observed in boys of every age from 5 months to adolescence.

(3) Sexual capacity, as measured by speed in reaching orgasm and capacity for multiple orgasms, is highest in pre-adolescent years and declines steadily (logarithmically) throughout life.

(4) Enormous individual variation in total sexual outlet occurs, e.g., frequencies range from 0 to 29+ times per week.

(5) The peak of actual performance (total outlet) is highest in the middle to late teens (single males: mean frequency 3.3 per wk.; married males, 4.8). It has dropped 50 per cent by age 50.

(6) The majority of males, up to age 50, utilize 2 or more of the 6 sources of outlet. From age 16 to age 25, about 90 per cent utilize 2 or more sources.

(7) The accumulative incidence of impotence is 6.7 per cent of males at 50 years of age, 20 per cent at age 60, 75 per cent at age 80.

(8) The males who enter adolescence earliest have statistically the longest and most active sex lives.

(9) Marital status tends to increase total outlet, while reducing but not eliminating outlets other than marital intercourse.

(10) Sexual patterns of behavior vary markedly for different social-educational strata.

(11) Masturbation is at least twice as frequent in the highest educational and occupational classes as in the lowest. The accumulative incidence of those who ever masturbate at any time is close to 90 per cent in all classes.

(12) Nocturnal emissions are three to four times as frequent in single males of the highest educational and occupational classes as in those of the lowest. The accumulative incidence for the total U. S. population reaches a maximum of 83 per cent at age 29, but is only 76 per cent in those of educational level 0–8 (yrs.), and is virtually 100 per cent in those of educational level 13+.

(13) The same general relation holds for heterosexual petting to climax, but the accumulative incidence is lower (16.5 per cent compared with 60 per cent).

(14) The accumulative incidence of pre-marital intercourse in the total population reaches 90 per cent. The incidence is higher for the lowest educational level (98%) than for the highest level (66%); and the frequency may be seven times as great. The incidence is lower for rural males than for urban.

(15) "Not more than 62 per cent of the upper level male's outlet is derived from marital intercourse by the age of 55."

(16) Coital techniques and the incidence of nudity in coitus vary markedly in different social strata. Variety of techniques and a high frequency of nudity characterize the upper educational level.

(17) "Mouth-genital contacts . . . occur at some time in the histories of nearly 60 per cent of all males." They are much commoner at high school and college levels than in those of grade school education only.

(18) About one-half of all white males engage at some time in extra-marital intercourse. It is highest in those of grade school educational level, but the incidence decreases with advancing age.

(19) Post-marital sexual activity, although less than the degree of marital activity, tends to resemble it far more than that of single men.

(20) The accumulative incidence for intercourse with prostitutes reaches a total of two-thirds of the male population, but it is very much lower (ca. one-third) in the college-bred group.

(21) Homosexual outlets reach an accumulative incidence of 37 per cent of all males. The incidence is higher for single males (50%), and is highest at the high school educational level. At any one time 22.9 per cent of males are calculated to be homosexual to some degree, 6.2 per cent exclusively homosexual. Homosexuality declines with age.

(22) Animal contacts are almost wholly limited to rural males. The accumulative incidence in the single rural population is about 17 per cent. It is highest in the college-bred group (29%).

(23) Social patterns of sexual behavior begin to appear in very early childhood. Children are the chief agents for the transmission of the sexual mores. "Exceedingly few males modify their attitudes on sex or change their patterns of overt behavior in any fundamental way after their middle teens."

The many graphs and diagrams in the book help to make these and numerous other significant relations clear. The reader who patiently plows through these masses of statistics and figures can come at the end to but one conclusion. Here is a study of heroic magnitude, carefully planned, patiently amassed, cautiously evaluated. It carries an overwhelming conviction of the honesty and reliability of its conclusions.

In the end, a number of matters stand out sharply in an altogether new light. In sexual behavior man is a characteristic mammal, and many acts banned by our traditional mores and widely regarded as "abnormal sex behavior" or "perversions" are known to be common in mammals. Kinsey's study shows that these forms of sex behavior are neither rare nor suppressed in man. Some of them are common; a number are well-nigh universal. With this revelation, the enormous discrepancy between our Judaeo-Christian mores and our legislation regarding sex behavior, on the one hand, and our actual behavior and moral attitudes, on the other, is inescapable. One of the first-fruits of this knowledge should be, as the authors maintain, a thoroughgoing examination and revision of our legislation on sexual matters. How wickedly unjust to sentence for many years a few unfortunate men by chance caught in the act, or reported by malicious persons to the police for an act, that a quarter or a half of all their fellows engage in with impunity. Penalties for sexual behavior must be placed on exactly the same footing as any other kind of illegal behavior, namely on the existence of demonstrable physical or psychological injury to another person.

But man is also a cultural animal, and this too is profoundly reflected in his sexual behavior. It is most significant to recognize that the patterns of *current* and *accepted* behavior are vastly different in different educational and social strata, even within a nation of so notoriously homogeneous a culture and so exaggerated a craving for uniformity as the United States of America. It is important to know that these patterns are virtually life-long in the individual; that they are established early in childhood and are largely transmitted through children; that religious beliefs are ineffective in suppressing or sublimating sex activities and are mainly capable only of diverting it from one outlet to another. And what must be the psychological consequences of so widespread a violation of moral taboos? The enormous individual differences in the frequency of sexual outlet among normal individuals, and the almost complete shift from pre-marital intercourse as the chief sex outlet for single males of one stratum to masturbation, in another stratum, have scarcely been suspected. With more justice than it ever had when applied to the economic conditions of living, we may now say: The one half doesn't know how the other half lives.

Freud was evidently right regarding the existence of an early sex life in children. On the other hand, it is now clear that much of the "aberrant sex behavior" he attributed to maladjustment arising in childhood is not aberrant sex behavior at all but a common type of sex behavior characteristic of a large proportion of well adjusted males. Homosexuality, for example,

may now be characterized as virtually an arrest of sex behavior at a pre-adolescent or early adolescent stage. The findings of this study cannot fail to effect a near-revolution in psychiatry and psychoanalysis, while at the same time providing these fields with a firmer base for the future.

This is only the first volume in a projected series of nine that will, over a period of 20 years, report on all phases of the 100,000 histories to be ultimately sought. In the present volume, some of the preliminary findings about white females are mentioned. The next volume in the series will consider that segment of the population in detail. Other volumes will cover such subjects as sex factors in marital adjustment, legal aspects of sex, heterosexual-homosexual balance, prostitution, sex education, etc. The entire series will represent a monumental achievement of the application of the methods of modern taxonomy to human biology.

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GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

THE LIVING THOUGHTS OF DESCARTES. *The Living Thoughts Library.*

Presented by Paul Valéry. David McKay Company, Philadelphia. $2.00. vi + 160 pp. + 1 plate. 1947.

Only recently (cf. Q.R.B. 22: 59. 1947) it was remarked that English editions of Descartes' *Discourse on the Method of Rightly Conducting the Reason* were almost unprocurable. That sad condition is now remedied by the appearance of a volume in the neat, pocket-sized Living Thoughts Library containing a penetrating introductory essay by Paul Valéry, and, in addition to a translation of the *Discourse*, two of the Meditations (the first and second from *Meditations on the First Philosophy*) and five Letters of some significance. There is a fine wood-cut portrait of Descartes as frontispiece.

Perhaps some day the story of the role intuition has played in the advancement of science may be written. When it is, Descartes must not be forgotten. As Valéry points out, Descartes' whole life achievement of the method for rightly regulating his reason and seeking scientific truth hinged upon the three dreams that visited him on a certain night of his youth (November 10, 1619) after a day of fervent mental effort and creative formulation—dreams that, Descartes said, had been exactly foretold to him by the Genius who that day possessed him. This is one of the most astonishing events in all the history of science. Perhaps it is paralleled only by Kekulé's half-waking, half-dreaming vision of the dancing carbon atoms that whirled themselves into the benzene ring. It would have appealed to William James, to write of "The scientist as dreamer...."

BENTLEY GLASS

A SCIENTIST'S APPROACH TO RELIGION.

By Carl Wallace Miller. The Macmillan Company, New York. $2.00. viii + 127 pp. 1947.

The author, Professor of Physics at Brown University, supports the fundamental orthodox Christian beliefs with reasoning that, while it will not always convince the skeptic, will greatly serve to strengthen the wavering. He is intelligent and broadminded and worth listening to, even though the extrapolation of the principles of physics into the realm of the spiritual is not without certain risks.

BENTLEY GLASS

THE SCIENTISTS SPEAK.

Edited by Warren Weaver. Boni & Gaer, New York. $3.75. xiv + 369 pp. 1947.

The Scientists Speak is the record, in book form, of the greatest effort that has yet been made to provide lay education in modern science. It is a collection of 79 brief addresses by leading scientists of the United States on subjects of their own immediate interest. The talks were originally given to radio audiences in the intermission periods of the New York Philharmonic-Symphony Orchestra concerts, from 1943 to 1946. They were carefully planned, with the special assistance of George W. Gray, to be general and non-technical, educational and inspirational in character.

Warren Weaver, chairman of the Advisory Committee which selected the speakers and helped to plan the talks, has supplied an introductory chapter, on Science and Complexity, which serves to introduce the authors and to place the entire series in focus. The talks, over one-half of which are biological in nature, are then grouped into related units, as follows: The Science of the Earth; The Science of the Sky; The Science of New Materials and Improved Processes; New Instrumental

Techniques—New Chemicals; Atoms and Molecules; Physics and Mathematics; Chemistry and Living Things; Plants and Animals; Fundamental Biology; The Science of Ourselves; Science and Health; The Natural and the Social Sciences; Science and the War; The Long-Term Values. The total result is a panorama of modern science of magnificent scope and general interest, a fact witnessed by the quarter of a million requests from listeners for copies of the talks, received by the CBS from all parts of the continent and from an astonishing variety of people of diverse social and economic status.

Teachers will find *The Scientists Speak* a veritable mine of useful and interesting scientific information and, as well, of invaluable examples of how to present scientific material clearly and simply to a lay audience. To the U. S. Rubber Company, sponsor of the programs, to George W. Gray, to the Advisory Committee, and most of all to the individual speakers themselves, the praise and thanks of American biologists.

BENTLEY GLASS

AMERICA'S ROLE IN THE GROWTH OF SCIENCE.
PRESENT TRENDS AND INTERNATIONAL IMPLICATIONS OF SCIENCE.
PROBLEMS OF INTERNATIONAL COOPERATION IN SCIENCE.
PILGRIM TRUST LECTURE.
(*Papers read before The American Philosophical Society and The National Academy of Sciences, October 17-23, 1926.*) *Proceedings of the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge, Volume 91, Number 1.*

The American Philosophical Society, Philadelphia. $1.50 (paper). iv + 136 pp.; ill. 1947.

Contents: The American Philosophical Society and International Relations (E. G. Conklin); America's Role in the Development of Astronomy (H. N. Russell); Growth of the Physical Sciences and their Applications in the United States (K. K. Darrow); Botanical Sciences and their Applications, including Agriculture (L. H. Bailey); Eighteenth Century Theories on America as a Human Habitat (G. Chinard); Trends in American Medical Research during the Nineteenth Century (R. H. Shryock); The Pilgrim Trust Lecture: The Freedom of Science, by Sir Henry Hallett Dale; Astronomy and International Cooperation (H. Shapley); New International Aspects of Oceanography (H. U. Sverdrup); Geophysics (J. B. Macelwane, S.J.); Mineral Resources in their International Relations (C. K. Leith); Epidemic Diseases (T. M. Rivers); International Problems in Plant Disease Control (E. K. Stakman); The Role of Amino Acids in Human Nutrition (W. C. Rose); Publication and the Distribution of Publications (A. Wetmore); The International Scientific Unions (J. A. Fleming); International Scientific Congresses (J. C. Hunsaker); The Interchange of Men of Science (R. A. Millikan); The United Nations Educational, Scientific and Cultural Organization (W. A. Noyes, Jr.).

SEX EDUCATION: *A Guide for Parents, Teachers and Youth Leaders.*

By Cyril Bibby. Emerson Books, New York. $2.50. 311 pp. 1946.

Written as a guide for those interested in sex education, the subject is approached here from a sociological viewpoint. The book is neither a text- or reference book, but a somewhat repetitious discussion of the problems and attitudes which may arise in undertaking sex education. Suggestions are made for the instruction of different age groups and for dealing constructively with attitudes encountered at the various age levels. The appendices contain a tentative scheme (tabulated) for sex education, suggestions for activities, sample lectures, and a good reading list.

This work would undoubtedly be a more satisfactory guide to sex education, however, if factual material concerning the anatomy and physiology of the reproductive and endocrine systems and some venereal disease information had been incorporated in the text. In the opinion of the reviewer, American teachers and parents prefer and can better use a more direct and inclusive presentation than is available here.

HARRIETTE D. VERA

DISCOVERING OUR WORLD: *Science for the Middle Grades. Basic Studies in Science. Books One, Two, Three.*

By Wilbur L. Beauchamp, Mary Melrose Williams, and Glenn O. Blough. Scott, Foresman and Company, Chicago, Atlanta, Dallas, and New York. (1) $1.48; (2) $1.52; (3) $1.64. (1) 224 pp.; ill. (2) 256 pp.; ill. (3) 304 pp.; ill. 1947.

These three books contain respectively eight, nine, and ten units, of which about half are biological in subject matter. There is relatively more biology to start with, and more physical science in Book Three. The study of biology (I) begins with the kinds of organisms, their need for water and air, the structures and functions of the human body, health and disease, animal and plant growth; (II) continues with plant and animal interrelations, movement, foods and nutrition, the sources of foods in plant processes, and gardening; and (III) ends with sound and hearing, light and vision, germs, plant and animal reproduction, and the evolution of life on the earth. The vocabulary is well

graded as to difficulty and the style is interesting. Especially commendable is the frequent use of the experimental approach and the suggestion of further simple experiments and activities for the young students. Each volume has a good index and a glossary of science words.

The illustrations are entirely in color. This may appeal to children in the middle grades; but the shades are gaudy rather than realistic and the colors are almost uniformly out of register.

BENTLEY GLASS

VITALIZED GENERAL SCIENCE.

By Barclay M. Newman; edited by Sebastian Haskelberg and Esther Boal. College Entrance Book Company, New York. 75 cents (paper). iv + 380 pp.; ill. 1947.

Although printed on cheap paper and bound in a way hardly likely to hold up under rough use, this general science textbook for a first year high school or junior high school course has excellent diagrams and catchy illustrations and is written in a clear, straightforward style. Of its four main parts, one is devoted to the science of life. This, unfortunately, is sadly unbalanced. For example, considerable detail about foods and digestion is offset by the complete disappearance of the kidneys from the body, excretion being regarded, apparently, as synonymous with defecation. Nor does the human body appear to possess either muscles or skeleton, although its nervous system and glands are well developed. More attention to a balanced treatment would make this a really good textbook. As it is, it cannot be recommended.

BENTLEY GLASS

OUR WORLD CHANGES. *Adventuring in Science. New Edition.*

By Samuel Ralph Powers, Elsie Flint Neuner, Herbert Bascom Bruner, and John Hodgdon Bradley. Ginn and Company, Boston, New York, Chicago, London, Atlanta, Dallas, Columbus, and San Francisco. $1.96. vi + 585 pp.; ill. 1946.

This newly revised junior high school science textbook is the second in a series of three, the other two of which have already been reviewed here recently (see Q.R.B. 22: 60, 141. 1947). It contains six units that deal with the phenomena of change in nature, three of them with respect to living organisms (The Changing World of Life; Our Life in a Changing World; Conservation in a Changing World). In addition, one section of the unit on The Changing Landscape is devoted to the story of organic evolution.

The book succeeds to an unusual degree in revealing the relations of plant and animal life to the environment. For example, the study of weather and climate leads naturally into a consideration of the effects of changing seasons upon plants and animals. A minor criticism might be made of the choice of desert and ocean habitats to exemplify adaptation. Perhaps these were chosen on the basis of dramatic interest, but grassland and forest might be closer to the common experience of American children, and have greater practical value. The inclusion of the section on fossils and prehistoric man is unusual in a book at this level, and is very welcome. The book's illustrations are very good, and there are lists of suggested experiments, readings, and science words, and an index. In sum, like the other books of this set, *Our World Changes* is individually excellent. Collectively, the set fails to cover biology in a fully comprehensive fashion. The emphasis is heavy on ecology, human anatomy and physiology, health and disease, conservation and economic aspects, and is correspondingly weak elsewhere.

BENTLEY GLASS

MODERN BIOLOGY.

By Truman J. Moon, Paul B. Mann, and James H. Otto. Henry Holt and Company, New York. $2.96. xvi + 664 + xlii pp.; ill. 1947.

This high school biology textbook presents a varied and comprehensive survey of the science of life. Its eleven units cover: The Scientific Study of Living Things (protoplasm, the chemistry of life); The Relationships of Living Things; The Biology of Plant Life; How Plants Affect Our Lives; The Microscopic World of Life; Simpler Forms of Animal Life; Animals With Backbones; How Biology Applies to Ourselves (human anatomy and physiology); Biology and the Problems of Disease; The Biology of Heredity (and evolution); and Safeguarding Nature's Inheritance (conservation). The text has been brought right up to date, and one will find discussions of the Rh blood factors, penicillin and streptomycin, DDT, riboflavin, nicotinic and pantothenic acids, plant hybrids, and other recent developments. Certain classic errors and misinterpretations have nevertheless been held over from the past, e.g., the wholly imaginary spireme; the dubiously hereditary defects of Jukes and Kallikaks; the unsubstantiated regulation of growth by the pineal body. The dating of the geologic eras is far out of line with the best estimates.

More surprising are certain peculiar gaps in the survey. Reproduction, for example, is scarcely mentioned in the consideration of man's own biology. The reproductive organs are completely omitted (save as endocrine organs), although all other systems are considered fully. A chapter is devoted to mammals,

yet no mention is made of marsupial and placental reproductive patterns. Embryos are considered as evidences of evolution, but there is no story of embryonic growth and development. Sex education is as neglected here in the high school as in the grades (cf. review of the Health of Our Nation series, above).

The two-column format is good, and the line drawings are excellent. But the numerous half-tones, because of unsuitable paper, show up very poorly. In spite of these defects, *Modern Biology* will deserve to continue to hold its high place among biology textbooks at this level.

BENTLEY GLASS

WORKBOOK IN THE INTRODUCTION TO THE BIOLOGICAL SCIENCES.

By Austin Ralph Middleton. The Hobson Book Press, New York. $3.00. xxvi + 478 pp.; ill. 1947.

This lithoprinted "workbook" contains notes on 41 lectures organized into ten units, as follows: Introduction to the Biological Sciences; The Kinds of Organisms; Classification of Organisms; Structure of Organisms; Distribution of Organisms; Problems of Organisms; The Importance of Organisms to Man; Structures and Functions of the Human Body; Genetics and Eugenics; Evolution. From p. 261 on, the book takes on the form of work-sheets, perforated for easy removal, and consisting of questions to be answered by the student, and occasional drawings to be labeled. A few original drawings are called for. The necessary space for answers and drawings is provided. Most of the "laboratory" work envisioned would appear to consist of book-work and discussion. Experiment and original observation have been reduced to a minimum —in fact, almost eliminated. For those who believe in the merits of such a course in biology, the book may merit consideration. To most teachers it will probably seem that the unillustrated lecture notes fall as far short of adequacy, as a textbook, as the work-sheets fail to indicate worth-while laboratory procedures.

BENTLEY GLASS

GENERAL BIOLOGY. *Second Edition.*

By Perry D. Strausbaugh and Bernal R. Wiemer. John Wiley & Sons, New York; Chapman & Hall, London. $4.75. viii + 718 pp. + 20 plates; text ill. 1947.

Without radically changing the plan of the first edition (reviewed, Q.R.B. 13: 455. 1938), the authors have greatly improved their widely used text by carefully eliminating small errors and misleading statements, by reducing the frightening number of boldface technical terms which studded the text, and by redrawing, with a marked increase in clarity, a good many of the figures. A glossary has been added, although there are still no references for supplementary reading. The chapter What Is Biology? now stands at the beginning of the book, and the discussion of the hormones has been enlarged to form an entire chapter. The subject matter has been brought up to date in most instances, although the mythical spireme has been retained, along with Jukes and Kallikaks, and the section on the evolution of man, considering its broad interest, seems very sketchy and not altogether up to date. The section on eugenics still seems the weakest in the book, and it could very well be curtailed so as to allow human evolution more scope. On the whole, the authors must be commended for an unusually painstaking job of revision, and congratulated for having made so material an improvement.

BENTLEY GLASS

BIOLOGY: HISTORY AND BIOGRAPHY

A FIFTEENTH CENTURY SURGEON: *Hieronymus Brunschwig and His Work.*

By Henry E. Sigerist. Ben Abramson, New York. $25.00 (with an original leaf from Brunschwig's *Chirurgia*, containing a large woodcut illustration); $15.00 (with an unillustrated original leaf); $3.50 (without any original leaf). 48 pp.; ill. 1946.

This excellent little essay on the 15th century surgeon, Hieronymus Brunschwig of Strasburg, is beautifully bound, printed, and illustrated. Forming originally the introduction to a facsimile edition of Brunschwig's *Book of Chirurgia*, it is in its new independence probably primarily destined for the bibliophile.

ERWIN H. ACKERKNECHT

THE SELECTED WRITINGS OF BENJAMIN RUSH.

Edited by Dagobert D. Runes. Philosophical Library, New York. $5.00. xii + 433 pp. + 2 plates. 1947.

This volume of *Selected Writings of Benjamin Rush* has appeared close to the 200th anniversary of Rush's birth, at a time when evaluation of his contributions and his character is highly fashionable. Reports of Rush, "good Dr. Rush," as Thomas Jefferson called him, by his contemporaries and by history, and what emerges of him from his own writings, agree in portraying him as contentious almost to the point of paranoia, but as uncompromising and courageous; as a utilitarian and a universal reformer, but obsessed with a great passion for liberty. "Remember the eyes of all Europe

are fixed upon you," he wrote to his countrymen, "to preserve an asylum for freedom in this country, after the last pillars of it are fallen in every other quarter of the globe." His profession was medicine; his many and diverse avocations all looked toward the construction of a programme for a greater ennoblement of the human spirit.

His strictly medical writings in most ways reflected rather than advanced the general attitudes of the late eighteenth century. The exception lies perhaps in the field of psychiatry. Here his advocacy of the use of occupational therapy as a therapeutic tool, his appreciation of the urgency for treatment of the insane and the alcoholic on a medical plane, his recognition of the facts that "many diseases take place in the body from causes that are forgotten . . . depression of mind may be induced by causes that are forgotten; or by the presence of distress into which it was at one time associated, but without reviving the cause of it in the memory"—all these mark him as a pioneer of wisdom and influence in the treatment of mental disease. The present volume would have done well to substitute excerpts from the *Medical inquiries and observations upon diseases of the mind* for the 15 pages devoted to the heavy humor of the papers on the different species of mania and phobia.

His humanitarianism, compounded out of sensitivity to individual human problems and of a vision of the possibilities for social progress, led him to call for reforms in many other fields than the medical, and many of his appeals are included in this volume: he crusaded bitterly against the evils of human slavery and against capital punishment; he campaigned as vigorously for the improvement of government, of education, of agriculture, of hospitals and sanitation. "Every man in a republic is public property," he wrote, and he was able to write and think always with both man and the republic in mind.

"The turgid style of Johnson—the purple glare of Gibbon . . . are . . . equally unnatural, and should not be admitted into our country," he wrote. His own style reflects his forcefulness of mind and purpose, and while his rhetoric, like his thinking, is sometimes interrupted by interjections characteristic of his century rather than ours, he has much to say to us today. His thought is pervaded by a note of confident optimism. "Why has the spirit of humanity made such rapid progress for some years past in the courts of Europe?" he enquired in 1786. "It is because kings and their ministers have been taught to *reason* upon philosophical subjects," and his hopefulness for the future is implicit in his answer. His times were in many ways akin to our own; we have much to learn from the signers, and all that they have to say is of importance. Perhaps our greatest need now is for leadership of the quality of their own, and what inspiration we may derive from their words cannot fail to help us to emulate them; the publication of this book is therefore a good contribution to contemporary thinking.

The construction of the book, so far as paper and print are concerned, is not quite worthy of the words and conceptions it carries; the "list of the writings of Benjamin Rush published during his lifetime," which constitutes part of the appendix, should clearly consist of more than a bare list of titles without any sign as to date or provenance.

JANE OPPENHEIMER

THE DEVELOPMENT OF MODERN MEDICINE: *An Interpretation of the Social and Scientific Factors Involved.* *By Richard Harrison Shryock. Alfred A. Knopf, New York.* $5.00. xvi + 458 + xv pp. + 10 plates. 1947.

A new edition of this history of modern medicine, originally published in 1936, will be welcomed by all those familiar with the rare qualities of the book. The fact that its author is not a medical man but a distinguished historian makes for emphasis upon the social and general historical implications of the subject. As, on the other hand, the purely medical matter is very competently and extensively dealt with, the book is actually superior to the "pure" medical histories. It might not provoke as much special medical thought as K. Faber's unforgettable *Nosography* or Sigerist's *Man and Medicine*, but as no other book, it will give to the doctor and "layman" (medical students, historians, sociologists, economists, biologists, etc., included) alike an understanding of what has happened to doctors and patients during the last two hundred years.

The book starts with an appreciation of what scientific elements existed in medicine in the 18th century and an analysis of the social and medical factors that retarded their growth. Due emphasis is given to the progress of preventive medicine in the 18th century (as later to the Public Health movement of the 19th century). Then the story of the unfolding of scientific medicine through the application of the basic sciences and of quantitative methods (a point dear to the author), and of the loss and regain of public confidence in the profession is well told, with much skill and scholarship. In the progress of the book, the emphasis shifts more and more to American experience. The last two chapters, the only ones which differ considerably from those in the first edition, because of extensive additions, deal with the rather depressing story of the fight for and against health insurance in this country, and the problems solved and still unsolved through the most recent advances in scientific medicine (like the antibiotics).

ERWIN H. ACKERKNECHT

A SURGEON'S DOMAIN.

By Bertram M. Bernheim. W. W. Norton & Company, New York. $3.00. 253 pp. 1947.

The author, Associate Professor of Surgery at The Johns Hopkins Medical School, has many interesting things to say: personal experiences in getting into surgery by "the back way"; reminiscences of great surgeons at work—J. M. T. Finney, Harvey Cushing, W. S. Halsted; notes on learning the job, and on growing stale. The book never flags. But Bernheim is best when he gets to grips with his convictions and expresses his views on the relations between visiting and resident surgeons, on fee-splitting and the economics of surgery, on the need for nurses. His central conviction is that surgeons should not engage in private practice but should be attached to hospitals and clinics as salaried personnel. While his view will no doubt not be shared by all surgeons, his long experience as Chief of Surgery and his arguments and reasons tend to carry conviction.

Biologists will most likely find their interest keenest in the all-too-short chapter on experimental surgery, in which Bernheim tells of his period of research under Harvey Cushing in the Hunterian Laboratory, and of the trials and rewards of experimental work on dogs. It is characteristic of the author that the chapter ends with him performing an emergency operation on his dog at home, for once the hero in his own family!

BENTLEY GLASS

THRILLS OF A NATURALIST'S QUEST.

By Raymond L. Ditmars. Halcyon House, Garden City, New York. $1.49. xiv + 268 pp. + 24 plates. [1932]; 1947.

Many a biologist will be grateful for the reissue in an inexpensive edition of this, perhaps the most popular of all Ditmars' books. This is the sort of story that makes naturalists. It has been previously reviewed in these columns (see Q.R.B. 8: 226. 1932).

ECOLOGY AND NATURAL HISTORY

ELEMENTS OF SOIL CONSERVATION.

By Hugh Hammond Bennett. McGraw-Hill Book Company, New York and London. $3.20. x + 406 pp.; text ill. 1947.

As would be expected, the author graphically states the soil erosion problem in the United States, shows its extent, the very serious effects which have already resulted, and the threat of soil erosion to the very heart of our agriculture. Because of their importance, the factors affecting rainfall penetration into the soil are emphasized. The changing point of view of the professional soil conservationists toward their problem as a whole is reflected in the statement that national action to conserve the soil resource must not only deal with soil erosion and related physical facts but must also cope with the complex economic and social considerations that affect the use of land.

The second half of the book deals with the various means and technics, such as the use of vegetation, contouring, terracing, channels and outlets, gully control, control of stream bank erosion, water spreading, small dams for water storage, farm drainage, and irrigation. Here, too, there can be noted those marked changes in the point of view of soil conservationists that have come about during the last decade. However, not all will agree that soil conservation, as such, is a major agricultural science.

This generously illustrated textbook seems quite suitable for use in American secondary schools. From the list of films and film strips at the end of the volume much effective material for supplementary teaching and propaganda can be obtained. The type is large and easily read, though the quality of the paper, and thus of the halftones, leaves something to be desired.

ROBERT L. PENDLETON

FOREST SOILS.

By Harold J. Lutz and Robert F. Chandler, Jr. John Wiley & Sons, New York; Chapman & Hall, London. $5.25. xii + 514 pp.; ill. 1946.

While the jacket states that this is a thorough treatment of soil science in its relation to the growth and distribution of forest trees, and that "important world research is summarized, interpreted, and critically analyzed," in reality this book deals almost exclusively with the temperate zone forests of the United States and Europe. More than eleven hundred references to the literature should prove very useful.

In view of the increasing opportunities for and responsibilities of scientists from the United States to deal with forestry problems in the Caribbean and other tropical regions, it seems odd that no mention has been made of the forestry work in Puerto Rico, nor of the soils studies of Mohr and others in the Netherlands Indies, of Corbet and Haines in Malaya, or of the important forestry work in India. Nor has the reviewer noted any mention of control of erosion and other studies on the forest soils of Japan. Because of the generally impoverished nature of humid tropical soils, tree crops are particularly appropriate on them. And it is from forests on such soils that the temperate zones are dependent for important supplies of the forest products: rubber, quinine, coffee, tea, cacao (chocolate), rotenone, shellac, rattan, etc. In the absence of some

general treatment of forest soils and forests in lower latitudes, the conventional discussion of laterization and laterite soils adds nothing to the stature of the book, and might well have been omitted.

Since this is intended as a textbook, it is not considered necessary to attract the reader nor to hold his attention; but for the general reader a somewhat different presentation of the subject would be more interesting. For example, chapters 2, 3, and 4 might well follow chapter 10.

ROBERT L. PENDLETON

DROUGHT: *Its Causes and Effects.*

By Ivan Ray Tannehill. Princeton University Press, Princeton. $3.00. xii + 264 pp.; ill. 1947.

Droughts are terrible catastrophes, but the sensational descriptions of human misery and the other unhappy effects of droughts which fill the first quarter of this book seem labored and affected. Specifically, only the droughts of the United States are considered, and many data are presented, largely in the form of curves, in an endeavor to show the correlation of the different sets of data. Very interesting relationships are shown between relative temperatures of the continents and of the oceans; of sunspot activity; rainfall intensity and distribution in space and time; etc. The significance of differences between values in various parts of the United States is pointed out, and the possible cyclic nature of these variations is considered. It is evident, however, that the sheer magnitude of studying and reducing to useful relationships the enormous masses of meteorological data already accumulated has prevented arriving at all the possible useful knowledge as to when and where droughts may be expected to occur. As the author says, if any one fact stands out in this study, it is that each local area will have to have its own drought problem solved separately from the others. The causes of rainfall are not the same in all parts of the earth, and, therefore, the causes of rain deficiency will not be the same everywhere.

The halftones are excellent and could well be used in a more conventional discussion of the measurement and recording of meteorological data. Many of the graphs would be more easily understood if larger; this would make it possible to label more values on the graphs themselves legibly.

ROBERT L. PENDLETON

A TREASURY OF ENGLISH WILD LIFE. *Britain in Pictures.*

Edited by W. J. Turner. Chanticleer Press, New York; distributed by Hastings House, New York. $5.00. 324 pp.; ill. 1947.

This is a collection of six books in one: *Trees in Britain*, by Alexander L. Howard; *Wild Flowers in Britain*, by Geoffrey Grigson; *Wild Life of Britain*, by F. Fraser Darling; *The Birds of Britain*, by James Fisher; *British Marine Life*, by C. M. Yonge; and *Insect Life in Britain* by Geoffrey Taylor. It constitutes a magnificent portrayal of natural history in the grand manner. There has been no effort to provide complete handbooks or keys for identification. On the contrary, the authors are as interested in the reflections of the natural history of their country in literature and in art as in nature itself. The object has been to introduce the reader to the richness of natural history, to delight, to amaze, even to intoxicate with its strangeness and beauty. The result is a book to be treasured always by its possessors, not only for the text but even more for the delicate and lovely masterpieces of drawing and painting reproduced from the work of the greatest British naturalists and artists of the past two centuries. The color plates must be seen to be believed. I cannot forbear mentioning in particular the work of a modern artist among them, Vere Temple, whose two plates (butterflies and dragonflies) achieve a mastery of color and design worthy of Hokusai. No book could offer more for the modest price asked.

BENTLEY GLASS

TREES IN BRITAIN. *Britain in Pictures.*

By Alexander L. Howard. Collins, London; [Hastings House, New York.] $1.50. 48 pp. + 8 plates. 1946.

See the review of *A Treasury of English Wild Life* above.

EVOLUTION

ESSAYS ON HUMAN EVOLUTION.

By Sir Arthur Keith. Watts and Company, London. x + 224 pp. 1946.

An alternate title for these essays might be: Evolution, Ethics, and War. In them Sir Arthur Keith has endeavored, under the stress of the mixed emotions of war-time, to assess a lifetime of thought upon the relation of evolution to human progress and civilization. The gist of his philosophy is as follows: Man's evolution has proceeded under a dual ethical code, a code of cooperation and kindliness as regards the in-groups, and a code of hate, enmity, and war directed against outsiders. Man's primitive instincts are of these two sorts. Civilization has arisen through the struggle, first between tribes and then between kingdoms and finally nations, as the in-group has expanded and the rivalry between increasingly powerful evolutionary units became more

deadly. Tribal isolation, now replaced by national isolation, has been and remains essential for the continuation of evolutionary progress. "Nations, if not actually distinct species," he quotes with approval, "may be varieties of the human race on the way to acquire specific distinction. . . . The German Nation is a biological unit at this critical stage of its evolution." War is the epitome of the struggle for existence in human affairs, and, whether we like it or not, a necessary outcome of Darwin's theory. "Where there is no aggression, as among the Australian aborigines, evolution tends to become stationary" (p. 165).

To point out all the unsubstantiated assumptions that underlie this philosophy would far exceed the scope of a short review. Nevertheless, certain major assumptions are so critical to Keith's point of view that merely to indicate them may be enough to reveal how unsubstantial is the logical edifice he has erected. In the first place, the noted anthropologist assumes that evolution —human evolution, at least—cannot change its direction. It must follow out the trend established in the past, or the species will come to a sad end. This view is a necessary consequence of his firm belief that "the essence of living protoplasm is its purposiveness" (p. 217), evolutionary as well as immediate. Few biologists will care to follow him here. Quite aside from the probability that, as G. G. Simpson has said, "A dispassionate survey suggests that much of the rectilinearity of evolution is a product rather of the tendency of the minds of scientists to move in straight lines than of a tendency of nature to do so," a sound concept of the relation of environment to the character of natural selection necessitates the view that a radically changed environment will alter the trend of evolution taken by organisms in it. In other words, even if we suppose that man has evolved under a dual ethical code up to recent times, there is no reason to believe that, in the vastly different physical and cultural environment with which man has surrounded himself today, the primitive trends must be preserved.

Secondly, there is Keith's unsubstantiated assumption that the nation is "an isolated group; it is an evolutionary unit" (p. 133). A nation is a political unit; perhaps it may even be a cultural unit—but that it is a biological unit of any sort is a quite unwarranted concession to Nazi philosophy. Gene frequencies vary from part to part of nations as greatly as from nation to nation. No one who has ever lived in China could make the astounding statement that "the inhabitants of China form one continuous uniform [*sic*] mass" (p. 181). While as for the United States—

A third unsound assumption basic to Keith's argument is that which identifies cultural change and progress in civilization with the biological evolution of the human species. How can an eminent anthropologist know so little of the strength of patterns of culture? Is there an iota of evidence that the "instincts" which lead to war are based upon heritable entities, genes or whatever? Is there any reason to suppose that because of war gene frequencies change materially? Populations live on, conquerors and conquered alike, and the killing of people is not the same thing as a change of gene frequencies in the surviving peoples? Keith has here assumed the very point to be proved. Finally, is there a shred of evidence that, in the 25,000 years or so of man's civilized existence, he has evolved biologically in the least? There is plenty of genetic heterogeneity, now as at the beginning of civilization. Mutation holds a balance against gene elimination by selection. Tribes and nations may disappear as distinguishable political or cultural units, but their genes are dispersed and intermixed with those of their successors rather than eliminated. In short, the trend has been from many small isolated groups toward "One World," and if any gene frequencies are changed in the process at all, there should be a selection of those that support the "ethical" code of human cooperation and brotherhood.

BENTLEY GLASS

ORGANIC EVOLUTION.

By Richard Swann Lull. The Macmillan Company, New York. $8.00. xx + 744 pp. + 31 plates; text ill. 1947.

A reprinting, with very minor changes, of the edition of 1927 can be of little service at this date. Modern evolution theory is conspicuous by its absence from the book. Even the paleontological treatment has not been brought up to date.

BENTLEY GLASS

GRAPTOLITES OF NORTH AMERICA. *Geological Society of America Memoir 19.*

By Rudolf Ruedemann. Geological Society of America, New York. $9.00. x + 652 pp. + 92 plates. 1947.

This paper describes and illustrates some 700 species of graptolites and presumably includes all of the North American species which had been established prior to 1942. Ruedemann has based his work primarily upon a study of the large collections of the United States Geological Survey but in addition has examined numerous other collections. The illustrations are in the form of line drawings, some of which are lacking in detail.

The systematic descriptions and illustrations take up some two-thirds of the monograph, the remainder being devoted to a general discussion of graptolites, including methods of investigation, terminology, morphology, phylogeny and affinities. This section of the text is necessarily brief but includes a rather complete bibliography up to about 1942. It is unfortunate that the

recent work of Bulman on the order Dendroidea could not have been included in this publication, but presumably the manuscript was in press prior to its publication.

THOMAS W. AMSDEN

CORALS FROM THE GULF OF CALIFORNIA AND THE NORTH PACIFIC COAST OF AMERICA. *The Geological Society of America Memoir 40.*

By J. Wyatt Durham. The Geological Society of America, New York. $1.70. vi + 68 pp. + 14 plates. 1947.

The bulk of this short memoir is devoted to a description and illustration of corals collected by the author from the Gulf of California and the North Pacific Coast region. In addition some specimens from the coasts of Mexico and Panama were examined, but much of the information on these corals has been taken from the literature. The present distribution of the genera and species of this Pacific Coast fauna is discussed, and some information on the ecology is presented. The author also lists the genera found in the Cenozoic deposits of California, Oregon, and Washington and compares the geographic distribution of the fauna during the several epochs of the Cenozoic with that found today. This discussion is, however, too brief to be entirely satisfactory.

THOMAS W. AMSDEN

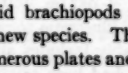
TEREBRATULOID BRACHIOPODA OF THE SILURIAN AND DEVONIAN. *Geological Society of America Special Papers, Number 38.*

By Preston E. Cloud, Jr. The Geological Society of America, New York. $1.50 (paper). xi + 182 pp.; 26 plates. 1942.

This carefully prepared volume fills a conspicuous gap in the knowledge of the brachiopods. Cloud describes and illustrates here all of the known Silurian and Devonian terebratuloid brachiopods and establishes 8 new genera and 11 new species. The material is well illustrated with numerous plates and text figures.

In addition to the systematic descriptions there is a chapter devoted to a discussion of the morphology and phylogeny of this group. There is also a section dealing with the methods used in preparing the specimens for study and illustration. Of special interest to those engaged in a study of fossil brachiopods is the technique used in making scale models.

THOMAS W. AMSDEN



CRETACEOUS AND TERTIARY ACTINOPTERYGIAN FISHES FROM BRAZIL. *Bulletin of the American Museum of Natural History, Volume 89, Article 1.*

By Bobb Schaeffer. American Museum of Natural History, New York. $1.00 (paper). 40 pp. + 7 plates; text ill. 1947.

The collection of fossils upon which the systematic portion of Schaeffer's paper is based contained few new forms or specimens of note. His study of the material, however, led him to the investigation of topics of broader interest. The occurrence of *Knightia* and *Diplomystus* in his materials is responsible for a study of generic characters and trends in these teleost genera and of the general evolutionary story of the double-armored clupeids, widespread in the Tertiary.

The origin of the South American teleost fauna is a major problem in zoogeography. Most of the fossil material from that continent is from Brazil, and Schaeffer makes a valuable contribution by gathering and summarizing the data on Brazilian fossil teleosts, together with a resumé of the geological sequence. The evidence afforded by the fossil record suggests to him that the origin of the South American fresh-water fauna may be traced in great measure to marine radiation rather than to migration over theoretical land bridges.

A. S. ROMER

REVIEW OF THE LABYRINTHODONTIA. *Bulletin of the Museum of Comparative Zoölogy at Harvard College, Volume 99, Number 1.*

By Alfred Sherwood Romer. Museum of Comparative Zoölogy at Harvard College, Cambridge. $4.00 (paper). 368 pp.; ill. 1947.

A. S. Romer is one of the world's outstanding authorities on the fossil amphibians and reptiles, so his recently published *Review of the Labyrinthodontia* is an event of unusual importance to all students of the early land-living tetrapods. By a remarkable coincidence, this work follows by a few months E. C. Case's monographic study of the labyrinthodont amphibians, recently published in the Transactions of the American Philosophical Society (see review, Q. R. B. 22: 216. 1947). Both of these authors carried on their researches quite independently of each other. Romer uses the superordinal term Labyrinthodontia, in contrast to the name Stegocephalia of Cope, favored by Case. In this he is following Watson, who in 1919 revived Owen's name for these primitive Paleozoic and early Mesozoic amphibians.

In the first part of his work, Romer presents an interesting and very useful section on the history of the classification of labyrinthodont amphibians, in which he reviews the classifications set forth by von Zittel (1902), Watson (1919, 1926, 1929, 1940), Abel (1919), von Huene (1920), Smith Woodward (1932), Säve-Söderbergh (1934), and Kuhn (1939). This portion of the work forms a background for Romer's own treatment of the labyrinthodonts as presented in this paper, a modification of his classification of 1945.

There then follows a long and extraordinarily valuable section on the general morphology of the labyrinthodont amphibians. This includes thorough discussions of the osteology of the skull, of the axial skeleton, and of the appendicular skeleton. In this section Romer takes up the question of vertebral structure in the labyrinthodonts as a basic factor in the classification of these animals. He shows how the rhachitomous vertebrae (particularly the early types that he calls proto-rhachitomous) are an ancestral character in the history of the labyrinthodonts. From early rhachitomous types he would derive the rhachitomous and stereospondylous vertebrae on the one hand, the embolomerous and seymouriamorph vertebrae on the other.

The bulk of the work is devoted to discussions of the genera of labyrinthodont amphibians. Each genus is considered separately, is briefly described, and its relationships with other genera are considered. Figures of the skull roofs of a great many of the genera are included in this part of the monograph. Needless to say, this section of Romer's paper will be indispensable to students of the early amphibians, and the remarks outlining the author's views of relationships are particularly helpful. It would have been very helpful if there could have been included a brief taxonomic review for each genus.

Following the discussions of the genera, there comes the section on the classification of the labyrinthodonts. Romer has here adopted a dichotomous arrangement of the superorder Labyrinthodontia, with two orders, the Temnospondyli (here he revives an old term) and the Anthracosauria. In the Temnospondyli are the suborders Ichthyostegalia, Rhachitomi, Stereospondyli, and Trematosauria; in the Anthracosauria, the suborders Embolomeri and Seymouriamorpha.

Among the Temnospondyli, the Rhachitomi are considered as the central line of evolutionary development, probably springing from ichthyostegid-like ancestors. It is shown, however, that the Ichthyostegalia as we know them, though primitive, are too far advanced to be the actual ancestors of later labyrinthodonts. Consequently these primitive forms are included within the Temnospondyli, but as a phylogenetic line apart from and "balancing" all of the other temnospondyls. The Rhachitomi are shown as trending into the Stereospondyli, and the Trematosauria are differentiated from the stereospondyls as a separate line of evolution. Here Romer stresses parallelism in evolution, which he considers of great importance in the phylogeny of the labyrinthodonts.

In accord with his previous publications, Romer suppresses the phyllospondyls, since he regards these as merely larval or small labyrinthodonts of various sorts.

In setting the embolomeres and seymouriamorphs apart from the other labyrinthodonts, Romer emphasizes the evolutionary direction followed by these amphibians, that eventually led to end forms quite different from the characteristic temnospondyls. He recognizes the fact that the embolomeres are very primitive labyrinthodonts, but he sees in them the indication of trends quite separate from the general rhachitome evolutionary line. These trends in the embolomeres finally led to the seymouriamorphs, which in turn were the direct ancestors of the cotylosaurian reptiles. Romer prefers to regard the seymouriamorphs as amphibians, though many authors would look upon them as representative of the very primitive cotylosaurs.

There is a final section in Romer's monograph on the stratigraphic occurrence of the labyrinthodonts. This adds greatly to the value of the work as a whole. An extensive bibliography is appended.

Throughout, Romer's work shows the result of his long study of the labyrinthodont amphibians. It is a major contribution of great significance, that together with Case's work will form a base for all studies on labyrinthodont amphibians in the future. For this reason, it is to be regretted that the format has imposed so great a reduction of the many fine figures of skulls in this monograph.

EDWIN H. COLBERT

STUDIES OF THE PHYTOSAURS MACHAEROPROSOPUS AND RUTIODON. *Bulletin of the American Museum of Natural History, Volume 88, Article 2.*

By Edwin Harris Colbert. American Museum of Natural History, New York. $1.00 (paper). Pp. 53–96 + 8 plates + 2 charts; text ill. 1947.

Despite the excellent work done by earlier authors on the phytosaurs—crocodile forerunners which are the commonest of American Triassic fossil reptiles—much remains to be done before the possibilities of research on the group are fully explored. Colbert here makes two distinct contributions toward this end. First, the description of a large skull of *Machaeroprosopus* leads to an analytical study of the systematics and phylogeny of this characteristic Chinle genus. He concludes tentatively that the various forms described from successive levels of the Chinle formation represent a growth series within a chronocline in the development of a single species, rather than a succession of discrete species. Secondly, the remounting and further preparation of a skeleton of *Rutiodon* from the Triassic of North Carolina permits the description of new features and characters not available to McGregor at the time of publication of his 1906 monograph. In connection with this, a long-neglected skull of this genus, in the Williams College collections, was studied. *Rutiodon* presents an interesting parallel in skull development to modern long-snouted fish-catching crocodilians, although specialization here is not as marked as in the European *Mystriosuchus*.

A. S. ROMER

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SEBECUS, REPRESENTATIVE OF A PECULIAR SUBORDER OF FOSSIL CROCODILIA FROM PATAGONIA. *Publications of the Scarritt Expeditions Number 35. Bulletin of the American Museum of Natural History, Volume 87, Article 4.*

By Edwin Harris Colbert. American Museum of Natural History, New York. 90 cents (paper). Pp. 217–270; text ill. + 6 plates. 1946.

It was long believed that the phylogenetic story of the crocodiles was (apart from a flurry of radiation in the Jurassic) a simple and straightforward one, leading from typical mesosuchian forms in the Mesozoic onward by slow degrees to the modern crocodiles, 'gators, and gavials. A decade ago, however, Simpson announced the discovery in the Eocene of South America of a radically different type of crocodilian, *Sebecus*. This, plus the very recent description by Price of another unusual type (*Baurusuchus*) in the late Cretaceous of that continent, indicates that in the later Mesozoic and early Tertiary South America was the home of a group of predaceous crocodiles very different from the normal types, and representing an independent suborder. Simpson's original description was brief and unillustrated; Colbert here gives a definitive account of the *Sebecus* material. In contrast with the flat-headed build of other crocodilians, the *Sebecus* skull was high and narrow, with laterally-facing orbits; the teeth large and laterally compressed, in contrast with the usual crocodilian pegs; the internal nares opened broadly onto the palate. What little is known of the postcranial skeleton is more normal in nature; but so divergent is the skull structure that it seems necessary to erect for this form a new suborder, the Sebecosuchia.

A. S. ROMER

THE MONOTREMES AND THE PALIMPSEST THEORY. *Bulletin of the American Museum of Natural History, Volume 88, Article 1.*

By William King Gregory. American Museum of Natural History, New York. 70 cents (paper). 52 pp. + 2 plates. 1947.

The preparation of his eagerly-awaited opus on the evolution of the vertebrates has led W. K. Gregory, in passing, to study many an interesting problem. Here he discusses the origins of the monotremes—a perennially tantalizing puzzle, made unusually difficult because of the reduction of the dentition, which so often furnishes good clues, and because of the almost complete absence of fossil evidence. A majority of workers, as Gregory notes, believe the monotremes to be a primitive group, widely removed phylogenetically from other mammals. Here he ably presents the "minority report," advocating their descent, by a rapid evolutionary development during the Tertiary, from an Australian marsupial stock. The palimpsest mode of study is the endeavour to discern, beneath the superficial habitus, the underlying basal heritage. From a comparative study of various features of both hard and soft anatomy, Gregory concludes that the heritage is that of marsupial forbears.

Despite Gregory's excellent presentation of anatomical evidence, the reviewer confesses that he is far from fully convinced; reproductive habits, about which Gregory says almost nothing, form a major stumbling block. It is hard to imagine that the egg-laying habit of the monotremes is not a truly primitive character; and if this be true, the argument for Australian marsupial relationship makes it necessary to believe that viviparity has developed, not once, nor twice, but several times in the Mammalia. Parallelism may have occurred; but the reviewer would rather believe that the parallelisms in the situation here have been in less fundamental features, and that the basic heritage resemblances between marsupials and monotremes date from a relatively remote stage.

Perhaps the seemingly barren Tertiary of Australia may some day give us fossil data to aid in a definitive solution of this problem.

A. S. ROMER

GENETICS AND CYTOLOGY

ORGANISME ET SEXUALITÉ. *Encyclopédie Scientifique publiée sous la direction du Dr. Toulouse. Bibliothèque de Biologie Générale.*

By Maurice Caullery. G. Doin & Cie., Paris. Paper. x + 342 pp.; ill. 1942.

This small volume is one of a series which has been appearing over a number of years under the general title *Encyclopédie Scientifique*. Illustrating the scope and variety to be found in these volumes, we may mention others in the field of biology (published or in preparation) that deal with such subjects as cellular biology, living cells in vitro, parthenogenesis, parasitism and symbiosis, insect societies, the species problem, heredity, etc.—all written by distinguished biologists. In keeping with the general plan, the present volume undertakes to survey the current state of knowledge in a particularly complex field for the general biological reader. This is a difficult task.

The manifestations of sexuality in living organisms—morphological and physiological; genetic, ontogenetic, or evolutionary—are incredibly varied. Different lines of approach developed for these major aspects of the problem long ago resulted in the creation of sharply defined provinces, the boundaries of which have begun to dissolve only in recent years. Consequently, the considerable knowledge accumulated in a few well-exploited areas is as yet difficult to correlate comprehensively. In only a few major taxonomic groups is

theoretical analysis possible in any detail; and postulates reasonably grounded in one group cannot yet be safely extended to others, or only in the most general terms. Accepting these limitations, the present volume attempts only to present clearly and concisely the status of certain outstanding problems, some classical (e.g., the problem of germ line vs. soma), others as modern as endocrine interrelations in the reproductive cycle, or the experimental analysis of sex differentiation. As a result, some areas are passed over in summary fashion, some treated as adjuncts of others; however, unity is achieved by virtue of organization around certain central problems which have been approached through more than one field. The material chosen for presentation is selected on the basis of its apparent reliability and lasting significance; sometimes, it would seem, for its consistency.

The book consists of an introductory section on sexuality in unicellular organisms and the simpler metazoa, in particular the nature and characteristics of gametes; after which the evolution and ontogenetic history of gametes is outlined by reviewing the classical concepts of primordial germ cells, germ line, and gonad formation, and the essentials of gametogenesis and meiosis. The first major division of the book describes sexdimorphism and its multiform expressions, especially in vertebrates. The phenomena of hermaphroditism vs. gonochorism, and secondary sex characters and their dependence on the gonads (or lack of it) are treated, with an analysis based mainly on the literature of castration. The next section is physiological in its approach, and also refers almost exclusively to the vertebrates. The theme is the role of sex hormones as integrators in adult physiology, specifically, the female sex cycle in mammals and the hypophysis-gonad relationship. There is a chapter on the chemistry of the sex hormones. The third part presents the elements of the theory of zygotic sex determination. The statistics of determination, together with data on fetal sex ratios and ratios at birth, are discussed for a number of species.

Part 4 (100 pp.) is devoted to the problems of sex-differentiation and intersexuality, with the treatment based mainly on the modern experimental analysis in three classes of vertebrates—amphibians, birds, and mammals. Naturally occurring forms of intersexuality are discussed as an introduction to the experimental attack; and use is also made of the information and concepts previously developed, so that this section is, to a degree, a synthesis. The effort to bring the phenomena of gynandromorphism, and the classical cases of intersexuality in *Bonellia* and *Lymantria*, within the theoretical framework is permissible only because of the very general terms of treatment.

As an exposition for the general reader, this book succeeds very well. Its simplicity and economy of language are admirable. The question may arise whether the subject has been made too clear. The bibliography is well selected and arranged by chapters, and there is a systematic and topical index, and an index of authors. Obvious physical defects are incidental and unavoidable. Published in 1942, it suffers greatly in material quality, especially as to paper and illustrations. As a result of the war it has only recently become available in this country, and consequently it is in some respects already seriously out of date. But when all is considered, it is perhaps an achievement that it could be produced at all.

ROBERT K. BURNS

CYTOLOGICAL TECHNIQUE. *The Principles and Practice of Methods used to determine the Structure of the Metazoan Cell. Second Edition. Methuen's Monographs on Biological Subjects.*

By John R. Baker. Methuen & Company, London; The Chemical Publishing Company, Brooklyn, New York. $2.25. viii + 211 pp.; ill. 1945.

This small handbook of cytological methods, now available in the United States, requires but a single word of praise. It is virtually the only manual to approach the subject courageously from the histochemical point of view. This alone should make it indispensable to the cytologist and histologist. Add to that many interesting sidelights on the historical development of cytotechniques and the characteristic differences in experience with materials, such as the newer synthetic mounting media, that inevitably mark workers in different countries, and no more need be said.

BENTLEY GLASS

GENERAL AND SYSTEMATIC BOTANY

PLANT BIOLOGY. *Second Edition.*

By Paul Weatherwax. W. B. Saunders Company, Philadelphia and London. $4.25. x + 451 pp.; ill. 1947.

Purposely scaled in proportion and treatment to a single semester course in botany, this second edition, like the first, is designed to meet the needs of the average student rather than those of the botany major. Consequently this book should, because of its simplicity of treatment, fulfil the requirements established in an elementary survey course. The fact that it is but mildly challenging will please those who comprehend with some difficulty. The few added facts and the recasting of old material hardly warrant a new edition at a time when the need for paper is so pressing.

C. P. SWANSON

BOTANY: *Principles and Problems. Fourth Edition. McGraw-Hill Publications in the Botanical Sciences.*

By Edmund W. Sinnott. McGraw-Hill Book Company, New York and London. $4.50. xviii + 726 pp.; ill. 1946.

The incorporation of recent botanical findings in the fields of antibiotics, genetics, and physiology, the expansion of certain portions of the section on plant geography, and a complete revision of the bryophytes by Hempstead Castle mark the latest edition of Sinnott's well-known botany text. The approach is more definitely physiological than previously, and it is thus in keeping with the present-day trends. With recent emphasis on one-semester courses in the sciences, some instructors will find the book too lengthy, but this objection can be overcome by a judicious selection of subject matter. Certainly in most respects the fourth edition of this book stands high among current texts as one of the more readable and authoritative in its treatment.

C. P. SWANSON

BASIC BOTANY. *An Introduction to the Science of Botany. By Fred W. Emerson. The Blakiston Company, Philadelphia and Toronto.* $4.00. xii + 372 pp. + 1 plate; text ill. 1947.

The publishing of a new textbook of botany at this time is a courageous undertaking, considering the large number of texts which are already available. Yet the necessity for a new approach to the science, particularly at the elementary levels, is evident; for botany, one of the basic biological studies, has long needed instructional overhauling. The traditional and stereotyped presentation, adequate possibly in the past, has not properly served its purpose of fitting the botanical sciences into the over-all pattern of a liberal education. The textbooks, almost without exception, have been scaled to those students who intend to continue with further specialization, and who in later courses generally repeat the identical subject matter time and again. The student who wishes a science course in order to understand his physical and biological surroundings better, but who has no intention or desire to specialize in botany, frequently finds himself repelled by the detailed facts and theories which, all too frequently, are of interest only to the professional botanist or to the botanical hobbyist. To the average student, botany has far more to offer than this. It has an intrinsic interest, a fascination, and a cultural value which far transcend the technical implications of wood structure or taxonomic differentiations, interesting and important though these may be to the morphologist or the taxonomist, and to the future progress of the science itself. Within recent years the disciplines of cytogenetics and physiology have done much to integrate botany with the more fundamental sciences of chemistry, physics, and mathematics; but with the recent emphasis upon basic science courses for all students, and upon what may be called a "humanistic" approach to science, it is apparent that the broadening of botany, at least at the elementary level, must also extend in the opposed direction, into the fields of economics, sociology, and even political science.

To demonstrate the point in mind, one needs only to mention two aspects of botany which generally receive but cursory treatment in our elementary textbooks. The parallel rise of civilizations with the domestication of plants presents one of the most fascinating stories of botany. The study of the development of the Indian civilizations of North and South America on an agriculture based on Indian maize not only cuts across the fields of archeology, sociology, history, and even religion, but it also demonstrates and elucidates some of the principles and problems of geographic distribution, plant origins, ecology, and cytogenetics. Likewise, every student of botany who has heard of hybrid corn knows the importance of the scientific principles of breeding techniques and of heterosis. Yet few are cognizant of the significance of this discovery in terms of our national economy, our standard of living, and our agricultural practices. Some will argue that none of this is botany, and in the older sense of the word it may not be; but if, as teachers, we are to integrate our science with our pattern of social existence, and to relate it in all of its ever-ramifying aspects to our every-day problems, the validity of such an argument has no real basis. Knowledge for its own sake is good, but an integrated knowledge is far better.

Emerson's book is done in the traditional manner, and as such provides no real contribution to botanical science, however well written and illustrated it may be. It differs, supposedly, from other texts in that the subject matter is presented from a unified point of view, with protoplasm as the basic unit of function and structure. But such an approach is not new; it is implicit, if not explicit, in most texts, and, indeed, **any** other would be inadequate when one considers the unity already created within the science by the discoveries of genetical and physiological workers. Granting that the unified plan of presentation is desirable, it is all the more difficult to understand why such an important protoplasmic manifestation as meiosis is as gingerly approached, incorrectly stated, and hastily passed over as it is here, when the simple facts, clearly presented, would have provided the physical basis for understanding the many phenomena subsequently discussed. Likewise, a more realistic integration of all energy transformation phenomena (photosynthesis, digestion, respiration, and the like), instead of the discursive treatment spread over four chapters, would have strengthened the book immeasurably.

Physically, the volume is an excellent one. Attractively bound, very well illustrated, and with the subject matter for the most part effectively and simply handled, it should appeal to the elementary instructor. The use

of our native North American flora in the discussions and illustrations will bring the science closer to the student. Studying aids are incorporated into the chapters, each being headed by an outline of the contained material and concluded by a summary of the important facts, succinctly organized. It is to be regretted that the book can do little, being what it is, to revitalize the botanical sciences.

C. P. SWANSON

GENERAL BOTANY LABORATORY BOOK.

By Edward M. Palmquist and Loren C. Petry. W. B. Saunders Company, Philadelphia and London. $2.25 (paper). vi + 174-a pp.; ill. 1947.

This is a flexible laboratory guide which can be adapted to almost any course in elementary botany, regardless of the assigned textbook. The material is balanced, the problems of structure and function are nicely integrated, and the drawings for labelling are diagrammatic in their clarity. Innumerable leading questions accompany each section, and assist in directing the student's attention to the important aspects of each laboratory exercise. The wire spring binding is an improvement over the loose-leaf type of laboratory manual, since it is more durable, yet also permits ready detachment of record and problem sheets whenever desirable.

C. P. SWANSON

A TEXTBOOK OF SYSTEMATIC BOTANY. *Third Edition. By Deane B. Swingle. McGraw-Hill Book Company, New York and London.* $3.50. xvi + 343 pp. + 1 pl.; text ill. 1946.

This is the third edition of a textbook of systematics designed primarily for teaching purposes, and describing some 67 orders and families of gymnosperms and angiosperms. Additions to the volume include a section on the mechanism of evolution, discussions of the more recent concepts of the species, a consideration of the experimental methods in taxonomy with the role played by cytogenetics, and the incorporation of floral formulae to the description of each family. The line drawings are well done, but the photographic reproductions, on the whole, are poor.

C. P. SWANSON

LA FLORULE DE L'ÎLE SAINTE-HÉLÈNE. *Contributions de l'Institut Botanique de l'Université de Montréal, Number 57.*

By Ernest Rouleau. Institut Botanique, Université de Montréal, Montréal. 50 cents (paper). 65 pp. + 1 map; ill. 1945.

This paper is an account of the vascular plants of Sainte-Hélène, a small island in the St. Lawrence River in the vicinity of Montreal. It contains historical notes on the discovery and human occupation of the island, its geological structure, the composition and distribution of its plant communities together with its phytogeographic affinities, a brief resumé of earlier works on the flora, and an annotated list of the plants now known to grow there. The author has himself made many collections from the island, and has utilized many specimens gathered by earlier workers.

The island has been occupied and used by Europeans since the time of the early French colonization of the St. Lawrence estuary. Discovered in 1611 by Champlain, it was first occupied by one François de Lauzon in 1635. Its native forests were probably of sugar maples and associated species, but these forests have been greatly reduced and modified through the years. With alteration of the native vegetation has come a great increase in the number of ruderal plants. The author's analysis of the changes that have occurred and his description of existing plant communities seem adequate and clear.

The annotated list of the flora, which makes up the main portion of the paper, enumerates 383 species, 58 varieties, and 21 forms. Its order of arrangement is that of Fr. Marie-Victorin's *Flore Laurentienne*, while the names used are brought up to date, following revisions that have been made since that work was published. Nearly all of the specimens cited are to be found in the herbarium of the University of Montreal. There are 12 range maps showing the local distribution, in the lower St. Lawrence basin, of species of unusual geographic interest. No keys or synonymy are given, and only a few notes on form and occurrence. There is an index to all species mentioned in the discussion and the list.

H. M. RAUP

THE FUNGI. *In Two Volumes.*

By Frederick A. Wolf and Frederick T. Wolf. John Wiley & Sons, New York; Chapman & Hall, London. (I) $6.00; (II) $6.50. (I) x + 438 pp.; ill. (II) xii + 538 pp.; ill. 1947.

Teachers and research workers in the field of mycology have awaited with considerable anticipation the appearance of Wolf and Wolf's book on the fungi. For the teacher, the summarizing in a two-volume work of the important and significant papers on the morphology and physiology of all the groups of the fungi could provide an invaluable text for both teacher and student. For the research man, it could be a guide to significant

papers in fields, other than his own, into which he wished to probe further. Since the present volumes were published in 1947, both these categories of users can expect that the most modern and up-to-date accounts of the groups of the fungi obtainable will either be given here or that reference will be made to them. This is particularly important in view of the vast amount of mycological knowledge that has accumulated as a result of the war.

Volume One is concerned with the development, structure, reproduction, and taxonomy of the fungi. After a brief preface in which the aims of the authors are stated, namely, to present a reference and textbook with a modern biological approach, there is a chapter on the history of mycology. This is followed by an informative discussion of the methods used in the isolation and cultivation of fungi. A subsequent chapter deals with classification and taxonomy and contains a key to the orders. Other chapters deal successively with the Myxomycetes, Phycomycetes, Ascomycetes, and Basidiomycetes. For each class, a general resumé of the structural features is given, followed by a discussion of the orders and important members of certain families. Special biological features of certain significant genera and species are given in considerable detail, as, for example, the extensive table summarizing information of spermatial formation among species of *Mycosphaerella*. Wherever possible, forms of economic importance are stressed, a feature which is especially helpful to the phytopathologist. After the discussion of each order and often after important families as well, there is a bibliography of presumably pertinent literature. The text is abundantly illustrated throughout with figures which, for the most part, are good and informative.

Whereas the first volume is concerned with morphology and, to a lesser degree, taxonomy, Volume Two deals with the activities of fungi and the effect of these activities upon their immediate environment. As the authors have aptly stated, it is "... physiological and ecological in its emphasis." In it, such fundamental topics as nutrition, enzymes and enzyme activities, and the biochemistry of fungi are discussed. There then follow chapters on the effects of temperature and radiation on various fungus activities and a discussion of the effects of the reaction of the substrate on the fungus itself. With respect to the hydrogen ion, the authors feel, perhaps rightly, that although studies show convincingly that its concentration is an environmental factor of great significance in modifying the metabolic activities of fungi, there is likelihood that too little attention has been given to the effects of other ions and that our present evaluation of this factor is a distorted one. A chapter of unusual interest on methods of spore dissemination follows. This subject is introduced with a resumé of certain quantitative data on the numbers of spores produced by single plants of certain fungi, numbers that will stagger even a mycologist. Accounts are given of the dissemination of spores in both aquatic and terrestrial fungi. Further chapters deal with spore germination and the factors influencing it and penetration of the host plant, topics which lead naturally to a consideration of physiologic specialization and variation among fungi.

Approaching more closely the ecological is a chapter that deals with phenomena due to different species living together in close proximity. These interactions of fungi on one another have been grouped into three categories, the antibiotic, or harmful effects, the symbiotic, or mutualistic advantages that result from living together of two or more species, and the synergetic. In the last named there "... are included those (effects) in which two or more species through their combined action produce effects or changes that neither could produce alone." There is then a chapter on mycorrhizae and mycotrophy, which is followed by chapters on special aspects of fungus activity, as, for example, one on genetics and several on fungi in relation to man. Under the latter topic are discussed the poisonous and edible fungi, and fungi in relation to disease in man.

After a most interesting and informative chapter on the geographical distribution of fungi, there follows a section devoted to mycology in relation to plant pathology. Here such topics as early concepts of disease in plants, contributory advances in bacteriology, significant events in the development of the field, resistance to disease of the host plant, and a summary of present trends in phytopathology are developed in masterly fashion. There are further chapters on soil fungi, fungus-insect interrelationships, marine fungi, and fossil fungi.

Author and subject indices terminate this volume as they do the first.

In the reviewer's opinion, the basis for any adverse criticism of these two volumes will stem fundamentally from the fact that the authors have assigned themselves a well-nigh impossible task, i.e., to meet the needs of teachers and to provide at the same time a reference book. In attempting to make their work inclusive enough for the research man, they have made it too comprehensive for the beginning student. In attempting to cut it down for the student, they have had to neglect the research man who seeks a relatively exhaustive treatment of an area in which he is particularly interested. There are also those who will question the choice of items included in the bibliographies of certain sections. For example, in the literature cited after an account of the Hymenomycetes, we find such items as Overholt's *Polyporaceae of Ohio*, but nothing of his later, more authoritative, *Polyporaceae of the Middle-Western United States*. Similarly, Kauffman's *Agaricaceae of Michigan* is cited, but no mention is made of his important later generic monographs. The text is exceptionally free of distracting typographical and other errors,

one notable exception being the inclusion in Fig. 58, to illustrate some common poisonous fungi, of *Morchella esculenta*.

Whatever may be the specific criticisms, and however short these volumes may fall of the goal expected of them, no one can question that they are significant contributions to the literature of mycology.

F. K. SPARROW

THE GENUS CYPERUS IN MEXICO. *The Catholic University of America Biological Studies Number 1.*

By Brother Benedict Ayers. The Catholic University of America Press, Washington, D. C. $1.25 (paper). xxi + 103 pp. 1946.

Seventy-three species and fifteen varieties of *Cyperus* are treated in Ayers' paper. Not all of them are described in detail, however, though references are given to four earlier papers published by the Catholic University of America, and to one in the papers of the Carnegie Institution of Washington, for full descriptions of the remaining plants. Since most of the work was done during the war, it was impossible to borrow specimens from Europe or from Mexico. Consequently, the physical basis for the study was limited to the herbaria of the United States. Extensive loans were made from the principal of these, and the author had access also to many of the photographs of European types in the Field Museum's collections.

The key to the species is entirely artificial, but the author presents, without discussion, a synoptic arrangement of the subgenera and sections that he recognizes among the Mexican species.

In addition to the synonymy and description of each species, given either by reference or in detail, the author has included a comprehensive citation of specimens, arranged geographically by states, the latter in alphabetical order. The paper closes with a list of species doubtfully occurring in Mexico, an annotated list of the exsiccati cited, and an index to specific names.

H. M. RAUP

TREES AND SHRUBS OF NANTUCKET: *Descriptions, Identification Keys, List of Trees and Shrubs.*

By Mabel Agnes Rice. Published by the author, Natural Science Department, The Maria Mitchell Association, Nantucket, Massachusetts. 75 cents (paper). 77 pp. 1946.

Approximately the first half of this little book is devoted to an interesting and informative history of the trees of Nantucket Island. The author makes no claim to having solved the problem of whether the island was ever forested, but she has assembled a formidable array of facts with which to approach the problem. These facts she has culled from many sources (a bibliography is included), ranging from early town records and early explorations to modern botanical and geological papers. In addition to the historical aspects of Nantucket trees, she has an excellent treatment of their present condition and distribution, with notes on the factors governing their growth and survival. The whole discussion appears to be critically thought out, well organized for logical presentation, and done in excellent style.

The latter half of the book contains a key for the identification of the trees and shrubs of the island. It covers both native and introduced species. The botanical nomenclature is that of the 7th edition of Gray's *Manual* or the 2nd edition of Rehder's *Manual of Cultivated Trees and Shrubs*. The key is followed by lists of the trees and shrubs, wherein the Latin names are followed by a common name and a specific locality on Nantucket Island where a specimen can be seen. By means of single and double asterisks, the author has indicated the species that are native, those that were regarded by Bicknell as introduced at the time he published his list (1908–1919), and those that have been introduced since that time.

The book will be extremely useful for botanically minded travellers and vacationers on Nantucket. It will also serve as a source book for students of the history of vegetation on the southern New England coast. It is handy in size, lithoprinted from typewritten sheets. A map of the island would be a welcome addition if the book were reissued.

H. M. RAUP

CONTRIBUTIONS DE L'INSTITUT BOTANIQUE DE L'UNIVERSITÉ DE MONTRÉAL, *Number 56.*

Institut Botanique, Université de Montréal, Montréal. $1.00 (paper). 118 pp.; ill. 1944–45.

Number 56 in these contributions contains 10 short papers, the titles of which are self-explanatory. As usual, the papers are published in French. The following is a list of them, with titles in translation:

Two new Astragali from Quebec (Jacques Rousseau); Teratological records on the indigenous flora of Quebec (Fr. Marie-Victorin and Jacques Rousseau); *Artemisia* of the section *Dracunculus* in Quebec (Fr. Marie-Victorin and Jacques Rousseau); Some minor phanerogamic entities in the flora of Quebec (Fr. Marie-Victorin); Reconstitution of the prehistoric *Ambrosia* of the Ozarks (Jacques Rousseau); Floristic impressions of Porto Rico (Fr. Marie-Victorin); *Juncus articulatus* L. in Quebec (Fr. Marie-Victorin); Taxonomic notes on the phanerogamic flora of Quebec. I (Ernest Rouleau); An endemic *Lycopus* of the St. Lawrence estuary (Fr. Rolland-Germain); Notes on the genus *Rosa* in Quebec (Bernard Boivin).

PLANTS: *A Guide to Plant Hobbies.*

By Herbert S. Zim. Illustrated by John W. Brainerd. Harcourt, Brace and Company, New York. $3.50. x + 398 pp.; ill. 1947.

Written for the hobbyist who has botanical leanings, but who has had little in the way of formal instruction in the science, *Plants* is an attempt to point out the problems and studies in the botanical field to the layman while at the same time it minimizes the highly technical aspects. In following out his aim, Zim has presented a considerable amount of information in simple language, and has interspersed this with much botanical lore. The reader should not find the text difficult. The presentation is somewhat disorganized, however, and the style unpolished and jerky; the author, it would seem, has glamorized a subject that would appeal but to a limited few. Some errors are evident, but they are such errors of oversimplification as are introduced whenever technical material is reduced to the level of the layman. On the other hand, the author might well be commended for the enthusiasm he brings to a subject which too frequently has only the vitality of a well-preserved herbarium specimen.

C. P. SWANSON

ECONOMIC BOTANY

THE AGRICULTURAL DEVELOPMENT OF THE MIDDLE EAST. *A Report to the Director General, Middle East Supply Centre, May, 1945.*

By B. A. Keen. His Majesty's Stationery Office, London. $1.60. xii + 126 pp. + 15 plates + 2 maps. 1946.

The Middle East extends from Cyprus in the north to the Sudan in the south, from Persia in the east to Tripolitania in the west; it includes 14 countries with a population of perhaps 70 million. The Middle East Supply Centre was a joint Anglo-American Agency set up in 1942 to insure that the civil population in the Middle East countries was provided with those supplies which were essential for their livelihood in war-time. The author, the well-known soil physicist, spent 10 months in the field studying the agricultural problems and their closely associated educational and rural problems. He describes the characteristic agriculture country by country, and shows that the feudal system and fragmentation of holdings are serious obstacles to agricultural progress. Ten examples of new systems of agriculture now employed in the Middle East are described; important lessons can be learned from them for further planning. Possibilities of improving the existing systems of agriculture are also considered, in regard to the landowner class and the tenant and peasant proprietor. The importance of rural education and the development of rural leaders is emphasized. Scientific and technical problems, particularly as concerns the soil and plant nutrition and growth, are considered in some detail, as well as crop rotation, plant improvement, seed production, plant pests and diseases, and livestock and fodder problems. Finally, the supply and development of agricultural information and advice are shown to depend both upon the training of appropriate staff and upon the establishment and staffing of a number of agricultural experiment stations. Numerous significant first-hand observations support the broad conclusions. This is a book which no one concerned with the Middle East can afford to overlook.

ROBERT L. PENDLETON

GARDENING WITH SHRUBS *and Small Flowering Trees. By Mary Deputy Lamson. M. Barrows and Company, New York.* $3.00. 295 pp. + 15 plates. 1946.

The time-consuming demands of our present day civilization often make it impossible for many lovers of beauty to maintain a garden in the ordinary sense of the word. For such persons a garden of shrubs is the logical answer. When properly chosen and planted these "friends of the busy gardener" require little care or expense and afford beauty throughout the year.

This book is a complete guide to the selection and maintenance of the proper shrubs for a great variety of purposes; and by the same token it is an excellent treatise on the art of landscape gardening. The scope of the work may be judged by the section headings: Description of Shrubs; Places to Plant Shrubs; Shrub Gardens [Roses, Evergreen, Fruit, Flower]; How to Study Shrubs; How to Select and Grow Shrubs. The text is well and interestingly written and, while it covers a wide range of subjects, the several chapters are not too lengthy.

The value of the book is greatly enhanced by twenty-six lists of carefully chosen species which are adapted for some special purpose. The lists are concerned with such matters as fall or winter color (emphasizing bark, fruit, and foliage characters), color values, foliage texture, color of flowers (arranged in order of flowering), combinations of color, and desirable species of flowering crabapples, cherries, plums, and peaches. Other headings include shrub borders at a distance, nearby borders (emphasizing fragrant species), shrubs around the house, low hedges, untrimmed hedges, and wall shrubs. A list featuring combinations of shrubs and flowers is of especial interest. In each case the list supplies the scientific name, the common name most frequently met with in nursery catalogs, and brief data regarding height, habit, proper location, color, etc. Planting plans for a lawn and for an informal green garden are included.

One section of the book is devoted to methods by

which one may become better acquainted with shrubs utilizing parks, arboretums, nurseries, the experience of friends, and nature itself. Another section is concerned with planning the grounds, the selection and ordering of the shrubs, planting and transplanting, fertilizing, pruning and watering. An adequate index of the species referred to is appended.

ALBERT F. HILL

AROUND THE GARDEN.

By Dorothy H. Jenkins; illustrated by Joseph Schultz. M. Barrows & Company, New York. $2.50. viii + 206 pp.; ill. 1947.

Garden books are so numerous that the reading public may well wonder why new ones are written. But for *Around the Garden* such will not be the case. This little book, based on material which appeared under the same title in the pages of the New York Times from October 1943 to June 1946, has a new approach and marshalls a great variety of pertinent facts with all the competence and efficiency of an assembly line.

The author carries the reader week by week throughout a typical year, and, as the foreword states, "reminds us of our garden duties with rare good humor and tact." Not only are the necessary chores indicated in their proper sequence, but there is such a wealth of information regarding gardens and gardening, the pleasures to be derived from the work and the beauty to be seen on every hand, that the book is a veritable streamlined encyclopedia. All phases of garden activities are touched upon in their proper time and place: the choice of seeds, planting, weeding, cultivating, watering, mulching, spraying, pruning, the control of enemies and disease, suggestions for laying out gardens, and a host of other matters. Both flower and vegetable gardens are considered, and shrubs, lawns, and house plants as well. Careful perusal of this book cannot fail to help the reader, whether an amateur or a professional, attain that goal of all gardeners—a better garden.

ALBERT F. HILL

FIFTY TROPICAL FRUITS OF NASSAU.

By Kendal and Julia Morton. Text House, Coral Gables, Florida. $3.50. 118 pp.; ill. 1946.

This finely illustrated and carefully documented book, while dealing primarily with fifty of the indigenous and exotic fruits of the Bahamas, gives much needed information in regard to tropical fruits in general and is a valuable addition to the literature of tropical agriculture. Thumb-nail sketches, written in non-technical language, present many interesting facts concerning the history, characteristics, and utilization of the fruits, and the origin and ornamental value of the plants which produce them. Many attractive ways of preparing the fruits are included.

The fifty-five large close-up photographs, taken by the authors expressly for this work, show not only the whole fruits, but also others cut open to display their form, seeds, and flesh structure.

Unlike many popular works the scientific names are accurate and are in accord with the International Rules of Botanical Nomenclature. The common names for the most part are those used in Standardized Plant Names. Colloquial names are frequently appended.

ALBERT F. HILL

GENERAL AND SYSTEMATIC ZOOLOGY

A MULTITUDE OF LIVING THINGS.

By Lorus J. Milne and Margery J. Milne. Dodd, Mead & Company, New York. $4.00. x + 278 pp. + 16 plates. 1947.

The matter-of-fact style in which this book is written should appeal to those who find the "poetry of life" school of nature-writing too rich for their blood. The subject-matter includes almost everything the writers could observe, nearby and on their trips, of animals ranging from garden insects to marine invertebrates, and the Milnes are, on the whole, careful recorders of their chosen world of invertebrates. Sometimes the style is almost too simple, as in the chapter on mussels, which fails to emphasize that the diverse habits mentioned are of different species (at least on the Pacific Coast), and in an inept description of the western slope of the California Sierra. Chapters based on their own observation, such as the one on the ghost crab, are excellent. Considered as a general, albeit unsystematic, introduction to the curious ways of invertebrates, this is a useful book for the amateur and general reader, and it should fulfil its avowed purpose of inspiring others to observe for themselves. The book is illustrated with some good photographs, and more would have been welcome.

JOEL W. HEDGPETH

HISTOIRES DE MER. *Les Livres de Nature. Second Edition.*

By René Legendre. Éditions Stock, Delamain et Boutelleau, Paris. 100 fr. (paper). 255 pp. 1946.

This is a collection of essays and papers, many of which have been published in journals or delivered on some occasion or another. They all concern some phase of marine biology or fisheries, falling under such headings as the marine milieu, the moon and marine life, the sanitation of oysters, belugas, lobsters, fishing among

primitive people, the metallic oxides in the sea, and a brief address on the role of marine laboratories.

This book has evidently met with some success in France, since this is the second edition.

JOEL W. HEDGPETH

ANIMAL INN: *The Stories of a Trailside Museum. By Virginia Moe; pictures by Milo Winter. Houghton Mifflin Company, Boston.* $2.50. xvi + 175 pp.; text ill. 1946.

Virginia Moe is the Director of the Trailside Museum of Natural History at the edge of Thatcher Woods, on the outskirts of Chicago. Here, after a pattern for Trailside Museums set by Hermon Carey Bumpus, originator of the idea, injured creatures of the wild and orphaned baby animals or birdlings are received and cared for, in as free a manner as possible. The children who live nearby may become Junior Assistants, and help with the chores, bathing the new robin's eyes with warm boric acid, gathering dandelions and clover for the wild cottontails, handling the new skunk so he will grow tamer, or getting fresh sand and bedding for the mouse's home. When the injured have recovered, they are freed; but the babes who grow up in the Museum are kept for life and soon learn to recognize their young human friends. The Director writes in a warm, simple manner of her many animal friends, from the tiniest meadow mouse to the largest of them all, a whitetail fawn named Bambi, who stayed at the Museum for a year, until he grew too large for such an establishment and had to be shipped away to a ranch in Texas. The author knows the personalities of her charges so well that she can write of them intimately without the least false humanizing of their ways or thoughts, and consequently she has written one of the best of natural histories. The woodchuck and opossum; the flying squirrels; the gray fox; the barred owls and the screech owl; the polecat, the rat, and the rabbit; turtles and salamanders; fox squirrels, gray squirrels, and red squirrels; raccoons and skunks; baby birds; and even a bullfrog—all come to life and become familiar friends or self-contained acquaintances in the author's story. She has no great knowledge of formal biology, as a few slips show; but she writes of what she has seen and lived with, day after day, and the trained biologist could do worse than to sit humbly at her feet. Of practical knowledge about how to feed little orphans and care for injured animals she also imparts a good deal. The book, of course, is written for children, but I would defy an adult biologist not to enjoy it. The drawings, too, are charming.

The conclusion, surely, is this, that we need many more Trailside Museums. Every city ought to have one.

BENTLEY GLASS

THE DATES AND EDITIONS OF CURTIS' BRITISH ENTOMOLOGY. *Smithsonian Miscellaneous Collections, Volume 107, Number 5. Publication 3894. By Richard E. Blackwelder. Smithsonian Institution, Washington, D.C.* 25 cents (paper). ii + 27 pp. + 4 plates. 1947.

The author has given us a method by which the dates of publication of the first and second editions of various parts of Curtis' 16 volumes (each volume with 12 parts, or 770 plates in 192 parts, 1824–1839) can be established. This is of value, since in the second edition of various parts there are revisions and additions in the text of a number of parts. Since in this work many genotypes were designated, the exact date of the appearance of the revisions, changes in nomenclature, or additions is of importance in establishing the genotype under the rules of nomenclature. Fortunately, Blackwelder has a complete set of the sixteen original volumes, with the plates and text in numerical order, as well as a second set, in 8 volumes, bound in systematic order with all the reprinted pages. In addition, he examined three other sets. In this paper the author has included facsimiles of all the pages in which nomenclatural changes occur; and other changes are discussed in their systematic sequence. This should give full information as to the dates of any part (1st or 2nd editions) of this important work that the student may have before him.

ROBERT MATHESON

A REVIEW OF THE NORTH AMERICAN SPECIES OF PHILANTHUS, NORTH OF MEXICO (*Hymenoptera: Sphecidae*). *Graduate School Studies: Contributions in Zoology and Entomology, Number 7. By R. W. Strandtmann. The Ohio State University Press, Columbus.* $2.50. vi + 126 pp.; ill. 1946.

Strandtmann has arranged keys to the males and females of some 23 species of *Philanthus* wasps (of which 2 are described as new) that he recognizes from America north of Mexico. The keys are based principally upon the character of punctation, coloration, pubescence and, in the male, the nature of the clypeal brush. As might be expected, these keys are not always easy to use; but as the specific descriptions are detailed and clearly written, this monograph should allow certain recognition of most species in the average collection. It may be helpful to point out that couplets 29 and 37 seem to require rewriting to eliminate apparent contradiction and ambiguity in the use of the ocellar triangle as a key character. A laudable feature of Strandtmann's monograph is his stated uniform employment of 15× magnification as the microscopic working basis for his descriptions.

In *Philanthus politus* Say, Strandtmann recognizes nine forms, each designated by a trinomial and held by him to be of subspecific rank. Whether this has been

a wise course is difficult to judge, as only about 500 specimens of each sex were studied, and the true range of variation in this species seems yet to be ascertained. Indeed, a general account of the variation and geographic distribution of the American species of *Philanthus* yet remains to be drawn, as only some 5,500 specimens of *Philanthus* were studied in all. Of the 23 recognized species, 16 were represented by less than 100 specimens each, and 10 of the 16 were known to Strandtmann from 20 or fewer specimens. Four recognized species are known from one sex only, and this is also the case for three of the alleged subspecies of *Philanthus politus* Say. No doubt this reflects the rarity of many of the species in existing collections. Although the reviewer considers the geographic data inadequate for a general picture, it is unfortunate that the information collected by Strandtmann has not been brought together in the form of distributional maps, for these would give some notion of the centers of distribution, etc.

The illustrations portraying individuals of the different species and their structures are notable, being well drawn and reproduced, and serve as indispensable supplements to many of the descriptions.

As this is purely a taxonomic monograph, it contains little new material upon the biology of *Philanthus*. Nevertheless, one marvels at the venational regularity of these wasps, for Strandtmann found but a single abnormally veined wing among the 5,500 specimens. The reviewer's wonder is also awakened as to the meaning of the markedly skewed sex ratios represented in the collected material. Nine of the species significantly depart from an equality of the sexes, and of these only *Philanthus albopilosus* Cresson shows a superiority of females.

In conclusion, it may be recorded that Strandtmann has done a very considerable service to students of wasps with this painstaking and well illustrated study. It may be hoped that he will one day complete the remaining gaps in our information (is *hirticulus* the male of *bicinctus*? what is *Philanthus barbatus* Smith? etc.) and provide a rich catalog of the distributional data so important and necessary to the student of evolution.

KENNETH W. COOPER

LA VIE DES REQUINS. *Histoires Naturelles—7.*
By P. Budker. Gallimard, Paris. 325 fr. (paper). 279 pp. + 22 plates; text ill. 1947.

This is a book about sharks rather than a comprehensive treatment of the biology of the elasmobranchs. The book is on the whole descriptive, considering such matters as classification, morphology, anatomy, man-eating propensities, and economic importance. There are also chapters on freshwater sharks, remoras, and on what might be called the folklore of sharks. As a popular treatise, written by an acknowledged authority on the elasmobranchs, this book has no counterpart in English, and it contains enough solid matter to be rewarding reading to those who must brush up on their French. An English translation for the general trade would probably be a profitable publishing venture, since almost everyone seems to be morbidly interested in sharks.

JOEL W. HEDGPETH

ENDEMIC FISH FAUNA OF LAKE WACCAMAW, NORTH CAROLINA. *Miscellaneous Publications, Museum of Zoology, University of Michigan, Number 65.*
By Carl L. Hubbs and Edward C. Raney. University of Michigan Press, Ann Arbor. 35 cents (paper). 30 pp. + 1 plate; text ill. 1946.

REVISION OF CERATICHTHYS, A GENUS OF AMERICAN CYPRINID FISHES. *Miscellaneous Publications, Museum of Zoology, University of Michigan, Number 66.*
By Carl L. Hubbs and John D. Black. University of Michigan Press, Ann Arbor. $1.00 (paper). 56 pp. + 2 plates; text ill. 1947.

A SMALL COLLECTION OF FISHES FROM RIO GRANDE DO SUL, BRAZIL. *Miscellaneous Publications, Museum of Zoology, University of Michigan, Number 67.*
By A. Lourenço Gomes. University of Michigan Press, Ann Arbor. 50 cents (paper). 39 pp. + 3 plates + 1 table; text ill. 1947.

These papers are among the results of the careful taxonomic work being done at the University of Michigan in ichthyology, and No. 66 in particular should be of interest to those concerned with the general problems of taxonomy, as it is especially representative of the methods now in use in this field. Those who doubt that taxonomists have a sense of humor should look up the derivation of the new specific name *callarchus*, as given on p. 47 of this brochure.

JOEL W. HEDGPETH

ANIMALS OF THE WORLD: *"Mammals of America"; "Mammals of Other Lands."*
Edited by J. Walker McSpadden. Garden City Publishing Company, Garden City, New York. $3.95. xx + 335 pp.; iv + 354 pp.; ill. [1917]; 1947.

Although the two books here bound as one date back some thirty years, they still present as comprehensive and well illustrated a popular treatment of the world's mammals as one can readily find in the English language. The two books are not identical in style, *Mammals of America* having a considerably fuller technical description (scientific names, dental formula, pelage,

measurements, range, food, related species and subspecies, etc.) of each animal considered than the companion volume. The latter is more characteristically the familiar "natural history." It is unfortunate that it has not been revised to correspond more closely to the *Mammals of America*.

The approximately 500 fine photographic illustrations are a striking feature of the book. Some of the plates are becoming worn, but the majority are still in good condition. The two books are separately indexed, and the index of *Mammals of America*, which consequently is at the center of the volume, is a bit difficult to locate quickly. The binding is sturdy and most attractive. The price, for these times, makes the volume a real bargain.

BENTLEY GLASS

FURRED ANIMALS OF AUSTRALIA.

By Ellis Troughton. Plates by Neville W. Cayley. Charles Scribner's Sons, New York. $5.00. xxviii + 374 pp. + 25 plates. 1947.

The author presents an account that, while popular in style, will appeal to any naturalist who would like to become better acquainted with Australian mammals. The animals are arranged according to their evolutionary relationships and are listed under both their popular and scientific names. In addition to a brief description of taxonomic characters, the outstanding traits of behavior of each species are discussed.

In addition, almost every form is represented on color plates accompanying the text. The result is that the author presents an outstanding picture of the nature of the Australian fauna, when viewed in its entirety. A person who previously has received only superficial impressions of the nature of Australian mammals will be surprised at the extent to which evolutionary diversification has proceeded within this continent. At the same time, however, the reader will be disheartened to learn that even today the people of Australia have not been able to establish and enforce laws that are adequate to protect even classical marsupial types and that everywhere the diversity of forms noted is being reduced.

Troughton gives a great stimulus to further researches in the marsupials by noting that relatively little is known of their paleontology and that observations to date suggest as remarkable a diversification of habit as of structure throughout the many ramifications of the group.

JOHN E. CUSHING

REPORT ON CETACEA *Stranded on the British Coasts from 1933 to 1937. British Museum (Natural History). Number 12.*

By F. C. Fraser. The British Museum (Natural History), London; B. Quaritch, London; Oxford University Press, London; and H. M. Stationery Office, London. 7s. 6d. (paper). 56 pp. + 7 maps; text ill. 1946.

This is the twelfth report on stranded cetacea in the British Isles. It includes accounts of 17 species represented in more than 200 strandings, with notes on size, color, dentition, and miscellaneous data. Of particular interest is the absence of the Blue, Finner, and Sei whales from this report of strandings, a possible indication of the dimunition of their stock in British waters. Most of the strandings are of the common porpoise. The report concludes with a key to the British whales and dolphins.

JOEL W. HEDGPETH

HUNTING BIG GAME: *An Anthology of True and Thrilling Adventures. Volume I. Africa and Asia. Volume II. The Americas.*

Edited with introduction and notes by Townsend Whelen. The Military Service Publishing Company, Harrisburg, Pa. $4.00 each; $8.00 set. (I) viii + 339 pp. + 24 plates. (II) 282 pp. + 26 plates. 1946.

These reprinted accounts of big game hunting in Africa, Asia, and America really require no review, inasmuch as none of them is new; indeed, the majority are fifty years old or more. These good old stories recall the abundance of game in days now gone forever, and the pioneering methods and frequent risks of the early hunters whose firearms were crude by modern standards and had as yet inspired little fear among the large mammals.

The first volume contains extracts from the writings of only five authors (Selous, Baker, Kirby, Neumann, and Littledale) who have described their hunts for lions, leopards, tigers, elephants, buffaloes, and sheep. The second volume includes stories by Roosevelt, Sheldon, Selous, Stefansson, Pike, Barringer, Sears, and Whelen on their experiences with bears, caribou, musk-oxen, mountain sheep, etc. Whelen's own contribution deals chiefly with field life and some of the smaller game in Panama. Each of these authors is introduced with a brief, and rather superficial, biographical sketch and with notes on the firearms he used.

These two volumes, though well worth reading, hardly justify the title of "An Anthology." The enormous literature on big game hunting includes so many classic and glorious volumes that these all-too-few selections are pitifully inadequate, even though they contain the names of Selous, Baker, Sheldon, and Stefansson. As an anthology and guide to the best books on the subject, the volumes under review are not nearly as serviceable as *From Shikar & Safari: A Big Game Anthology*, selected by E. H. Baxter (London, 1931).

A. H. SCHULTZ

BUMPY BISON.
By Nell Smidell Nesbitt; pictures by Colista Dowling. Binfords & Mort, Portland, Oregon. $1.50. vi + 92 pp. + 7 plates. 1947.

The author of this story about the life of a bison in the days of the great Western hunts has thoroughly informed herself about her subject. The life of the bison is told with sympathy and vivid detail. It is spoiled, however, by that fatal inclination of so many writers about animals to humanize their protagonists. "Bumpy Bison," the heroine of this tale, talks and thinks about like a little girl of five or six pretending to be a bison. The worst of it is that the children like it.

BENTLEY GLASS

GENERAL ZOOLOGY LABORATORY MANUAL.
By Mary D. Rogick. The C. V. Mosby Company, St. Louis. $3.25 (paper). 322 pp.; ill. 1947.

This neat laboratory manual, with a plastic ring binder, is arranged for a full year course planned as an extensive survey of animal types. It is emphatically morphological rather than physiological in point of view. Heredity, embryology, and evolution are also omitted. Numerous original drawings are required of the students. The manual itself contains some excellent diagrams and drawings.

BENTLEY GLASS

ECONOMIC ZOOLOGY

GALL MIDGES OF ECONOMIC IMPORTANCE. *Volume I. Gall Midges of Root and Vegetable Crops. Volume II. Gall Midges of Fodder Crops.*
By H. F. Barnes. Crosby Lockwood & Son, London. (I) 12s. 6d.; (II) 15s. (I) 104 pp. + 10 plates. (II) 160 pp. + 4 plates. 1946.

These are the first two volumes of a proposed series of eight volumes that will deal with gall midges that attack agricultural crops. Each volume is a complete account of those midges that are known to be of importance to the crops indicated. Each volume is to be arranged on the basis of Volume I. Briefly the arrangement is as follows: a brief introduction, indicating the scope (in Volume I, in addition, a delightful account of rearing and handling gall midges), and followed by a table of contents, a list of illustrations, a list of crops (both by common and scientific names), and then the midges of each crop, arranged alphabetically by the common names of the crops. Next follow a bibliography, an index of the midges treated under generic, specific, and popular names, and a plant-index, similarly arranged. Each volume has an extended bibliography (228 titles in Volume I and 305 titles in Volume II), and in addition for each gall midge discussed there is given its own special set of references. This is a very excellent method, for the reader does not have to search through the long bibliography to find those references which may give him more details.

The material in the present two volumes is well arranged, the accounts of the biology of the midges, the descriptions of the galls, and the effects on the host plants are written in an engaging and pleasant style and yet with scientific accuracy. They make pleasant reading not only for the entomologist, but also for the agriculturist and the layman, who will find in the volumes many accounts of these tiny creatures to arouse his interest and increase his desire to see them in the plants about him. The author does not restrict his work to our northern crops but treats crops found in all parts of the world, although the crop plants of Europe are those dealt with in detail. In most cases control measures are given.

If the present two volumes are an index of the six to follow, the author will have made a valuable contribution to our knowledge of the gall midges that attack cultivated plants. It is to be hoped the remaining volumes will appear promptly. The publishers are to be congratulated on the excellent presswork, clear and easily readable print, and the attractive bindings in green buckram with gilt lettering.

R. MATHESON

FISHERY RESOURCES OF THE UNITED STATES.
Edited by Lionel A. Walford; illustrated by Katherine Howe. Public Affairs Press, Washington, D. C. $5.00. vi + 134 pp.; ill. 1947.

This is an attractively bound edition of the Report of the Fish and Wildlife Service of the United States Department of the Interior (1945), with the graphs and pictograms printed in black and blue-green. It has been reviewed in these columns previously (Q.R.B. 21: 196. 1946). In editing it for issue as a non-governmental publication, the valuable section of conclusions and recommendations for governmental action has unfortunately been omitted. (Incidentally, the name of the editor, L. A. Walford, Chief of Atlantic Fishery Investigations, U. S. Fish and Wildlife Service, did not appear upon the original publication.)

The former review of the report said, "This report will be of special interest to conservationists, ecologists, economic zoologists, and fishery people. It should also reach a much wider group; teachers of biology in colleges and secondary schools, students, and all forward-looking citizens. By making it available so cheaply the U. S. Government continues to rank foremost as a publisher of scientific material at low cost." As a sufficient comment on the last of these sentences, one may suggest a comparison of the original price (40 cents) with the $5.00 asked by the present publisher.

BENTLEY GLASS

WATER QUALITY STUDIES OF THE DELAWARE RIVER WITH REFERENCE TO SHAD MIGRATION. *Special Scientific Report Number 38.*

By M. M. Ellis, B. A. Westfall, D. K. Meyer, and W. S. Platner. Fish and Wildlife Service, United States Department of the Interior, Washington, D. C. Paper; mimeographed. 56 pp. 1947.

EFFECTS OF AQUATIC WEED INFESTATION ON THE FISH AND WILD LIFE OF THE GULF STATES. *Special Scientific Report No. 39.*

By J. J. Lynch, J. E. King, T. K. Chamberlain, and Arthur L. Smith, Jr. Fish and Wildlife Service, United States Department of the Interior, Washington, D. C. Paper; mimeographed. ii + 71 pp. 1947.

EVALUATION OF FISHERIES IN DETERMINING BENEFITS AND LOSSES FROM ENGINEERING PROJECTS. *Special Scientific Report No. 40.*

By Richard A. Kahn and George A. Rounsefell. Fish and Wildlife Service, United States Department of the Interior, Washington, D. C. Paper; mimeographed. 10 pp. 1947.

DDT INVESTIGATIONS BY THE FISH AND WILDLIFE SERVICE IN 1946. *Special Scientific Report Number 41.*

By Arnold L. Nelson and Eugene W. Surber. Fish and Wildlife Service, United States Department of the Interior, Chicago. Paper; mimeographed. ii + 8 pp. 1947.

TOXICITY OF PHENYL-MERCURIC LACTATE FOR FISH. *Special Scientific Report Number 42.*

By M. M. Ellis. Fish and Wildlife Service, United States Department of the Interior, Washington, D. C. Paper; mimeographed. 6 pp. 1947.

The reports in this series are issued for limited distribution for official use of the Fish and Wildlife Service and cooperating agencies. As the titles indicate, they concern problems of immediate importance to conservation and wild life management, and often contain data of more general interest which deserve a wider distribution. This is especially true for the reports on water hyacinth and alligator weed, and on the Delaware River. The water hyacinth problem is well known to Gulf biologists, but its magnitude is probably not realized in other parts of the country. The annual loss due to it in Louisiana and Florida alone is estimated at 20 million dollars. In the Delaware River, lack of oxygen is declared to be the prime cause (induced by industrial and sewage pollution) for the decline of the fish population in that river. This touches upon the fact that many of these special reports concern problems of some political potential and tend to become obscurely buried even from the sight of specialists in the fields involved.

JOEL W. HEDGPETH

THE COMMERCIAL FISH CATCH OF CALIFORNIA FOR THE YEARS 1943 AND 1944. *Fish Bulletin Number 63.*

By the Staff of the Bureau of Marine Fisheries. State of California Department of Natural Resources, Division of Fish and Game, Bureau of Marine Fisheries, Terminal Island. Free upon request (paper). 81 pp. 1946.

DRIFT AND SET LINE FISHING GEAR IN CALIFORNIA. *Fish Bulletin Number 66.*

By W. L. Scofield. State of California Department of Natural Resources, Division of Fish and Game, Bureau of Marine Fisheries, Terminal Island. Free upon request (paper). 38 pp.; ill. 1947.

The second of these bulletins contains a full but concise description of the gear and methods of using it for fishing for sharks, rockfish and sablefish along the California coast.

OUTDOOR LIFE'S GALLERY OF NORTH AMERICAN GAME. *Prepared by the Editors of Outdoor Life Magazine. Paintings by Francis Lee Jaques. Outdoor Life, New York; Grosset & Dunlap, New York.* $5.95. 142 pp. + 30 plates. 1946.

The chief game mammals and birds of North America will become more widely known and better appreciated through this attractive volume. The text is composed of brief, popular essays by various writers who deal with the natural history, as it interests the hunter, of the following birds and mammals: five different ducks, the Canada goose, turkey, pheasant, quail, grouse, woodcock, mourning dove, cottontail and jack rabbit, fox, bobcat, mountain lion, wolf, coyote, our three bears, raccoon, moose, elk, mule- and whitetail deer, caribou, bighorn sheep, mountain goat, and pronghorn antelope. Each of these animals is pictured in a full page, colored reproduction of a painting by Francis Lee Jaques. These illustrations, faithfully and artistically executed, are very well printed and of generous size. In addition, there are numerous delightful pen-and-ink sketches by the same artist.

A. H. SCHULTZ

ANIMAL MORPHOLOGY

AN ANALYSIS OF THE GEOMETRY OF SYMMETRY WITH ESPECIAL REFERENCE TO THE SQUAMATION OF FISHES. *Bulletin of the American Museum of Natural History, Volume 88, Article 6.*

By C. M. Breder, Jr. American Museum of Natural History, New York. 75 cents (paper). Pp. 321-41 + 2 plates; text ill. 1947.

This study will bring to mind the classic work of D'Arcy Thompson, as it embodies the same fundamental approach to the symmetry of natural objects through

geometrical analysis. The scale patterns of several types of fishes have been analyzed in detail and compared with patterns produced by a "sine machine." The essential purpose of this study seems to be the placing of morphology on an analytical basis, and the comparison of scale patterns of fossil and recent fishes indicates "that as fishes have deepened or lengthened, in an evolutionary sense, the angles . . . between crossing scale rows have closed or opened accordingly, like the members of a pair of lazy tongs. . . . It is perhaps not too hopeful to anticipate a practical application of these organic grids and these distortions for a better understanding of the relationships of fishes."

JOEL W. HEDGPETH

GUIDE TO THE STUDY OF THE ANATOMY OF THE SHARK, NECTURUS, AND THE CAT. *Second Edition.*

By Samuel Eddy, Clarence P. Oliver, and John P. Turner. John Wiley & Sons, New York; Chapman & Hall, London. $2.00 (paper). viii + 115 pp.; ill. 1947.

Instructors of comparative vertebrate anatomy will find the same competent and manageable laboratory manual in this second edition that they knew in the first. The material is tailored for a one-quarter term course. The directions, admirable in clarity and adequacy, are supplemented by seventeen figures, largely diagrammatic, on such topics as the circulation of the shark gill arches, the shark brain and cranial nerves, the skull of the *Necturus*, or the muscles and the various regions of the vascular system of the cat.

Only occasionally are there items to which exception might be taken. For a third edition, the authors should consider revising the treatment of the carotid arteries in the shark, as it is at present out of line with the embryological evidence and with the usage of an increasing number of comparative anatomists. One wonders also if the student's time would not be saved in the end if the *major* divisions of the muscular system of the shark, the epaxial, hypaxial, etc., were to be included. At least, when these authors come to the muscular system of *Necturus* and the cat, they refer back in each case to the shark.

The excellent advice that to dissect well is to separate all the parts clearly, and not to cut them up, is worded in such a way as to challenge the over-informed student to point out to the instructor that the word dissect is not derived from the word to separate or even to demonstrate but comes from a Latin verb meaning "to cut off, cut up, or to carve." Elsewhere in the manual, mammals are called "the climax of vertebrate development." Since penguins cannot read, this will probably continue to go unchallenged.

GAIRDNER MOMENT

THE DISSECTION OF THE CAT.

By Harold Madison Messer. Ziff-Davis Publishing Company, Chicago and New York. $1.50 (paper). vi + 59 pp. + 14 plates. 1945.

This manual will provide a useful workbook for a thorough study of the anatomy of the cat by undergraduates. In the words of the author, it was written "with the specific idea of providing such complete directions for dissection and such definite descriptions of the structures that an average student could proceed with a minimum amount of help from other sources." In addition to the written directions, the book contains blank pages and partially completed diagrams for student drawings at the end of each section.

The manual is the result of years of actual laboratory experience, so that its practical effectiveness seems assured.

GAIRDNER MOMENT

AN ATLAS OF ANATOMY *By Regions: Upper Limb, Abdomen, Perineum, Pelvis, Lower Limb, Vertebrae, Vertebral Column, Thorax, Head and Neck. Second Edition.*

By J. C. Boileau Grant. The Williams & Wilkins Company, Baltimore. $10.00. xxvi + 496 pp.; ill. 1947.

This splendid, but limited, volume could be entitled more precisely: An Anatomical Atlas of Adult White Man. It does illustrate all the gross anatomical structures of man's fully grown body in a very adequate, clear, and accurate manner. The original edition, now four years old, has already been reviewed in this journal (Q.R.B. 19: 61. 1944.) The new, second edition has been considerably revised, and enlarged by the addition of approximately 200 new illustrations. The latter refer to nearly all bodily regions. Special mention is deserved by the series of new diagrams and sketches relating to the cranial nerves and by those illustrating the epiphyses of the limb bones, as well as the additional examples of "common anomalies discovered in the dissecting room." Though the inclusion of many anatomical variations is highly laudable, the selection of the variations presented seems somewhat arbitrary, being not always influenced by the frequency of their occurrence or by their scientific significance. For instance, there have been added instructive pictures of the comparatively rare unfused acromial epiphyses and of ankylosed sacro-iliac joints, yet there is no reference to variations in the bony elements of wrist and ankle and very little regarding the common numerical variations in vertebrae or the frequent extreme variations in cranial sutures. These, however, are very minor criticisms of such a generally useful volume, with its wealth of perfect illustrations and, last but not least, its reasonable price.

A. H. SCHULTZ

COMPARATIVE BIOLOGIC-ANATOMICAL INVESTIGATIONS ON THE VERTEBRAL COLUMN AND SPINAL MUSCULATURE OF MAMMALS. *Verhandelingen der Koninklijke Nederlandsche Akademie van Wetenschappen, Afd. Natuurkunde. Tweede Sectie, Deel XLII, Number 5. By E. J. Slijper. North-Holland Publishing Company, Amsterdam.* 6 fl. (paper). 128 pp. + 8 tables; ill. 1946.

This important monograph deals with the postural and locomotor adaptations of the trunk in mammals. More specifically, it deals with the morphology of the vertebral column; but it is not merely a study in osteology, for the vertebral musculature and ligaments receive considerable attention, and an attempt is made to correlate their arrangements with those of the bones. This study thus is concerned with the axial portion of what the Germans have termed the "Bewegungsapparat."

The skeletons of 90 different species of mammals and the musculature of 80 different species were investigated. These species cover a wide range, including monotremes, marsupials, edentates, insectivores, bats, rodents, fissiped and pinniped carnivores, tubulidentates, ungulates, sirenians, cetaceans, and primates. These are largely treated, not in an ordinal manner, but with regard to modes of posture and locomotion—thus, quadrupedal terrestrial, bipedal terrestrial, aquatic, etc.

The detailed observations and correlations cannot be discussed here, but some final conclusions of the author may be considered. Slijper concludes that the shape and size of the vertebral bodies depend upon the static function of the body-axis to resist bending in the dorsal direction; the dimensions of the bodies are strongly influenced, however, by the development of other axial elements. Structure and development of the epaxial musculature are influenced by static factors (e.g. absolute size of body), but they depend chiefly on the type of locomotion and corresponding type of vertebral mobility. Structure, development, and inclination of the neural spines depend chiefly upon structure and development of the epaxial muscles and hence chiefly upon the type of locomotion.

Slijper's implied thesis is that form depends upon function, rather than, presumably, vice versa. This raises a venerable and still pertinent problem of prime importance to comparative anatomists—which is the cart, and which is the horse? The strongest evidence presented for the author's view is in a bipedal goat which lacked forelimbs. In this animal, the vertebral apparatus exhibited surprising approximations to features found in mammals that normally exhibit an erect posture.

WILLIAM L. STRAUS, JR.

L'ORGANISATION NERVEUSE. *Sciences d'Aujourd'hui. By Remy Collin. Éditions Albin Michel, Paris.* 150 fr. (paper). 530 pp. + 40 plates; text ill. 1944.

This volume presents an interestingly written discussion of the organization of the nervous system. While the discussion is based principally on considerations of cellular structure, data concerning the grosser physiological activities of the nervous structures are necessarily included. Roughly a third of the book (around 150 pages) is devoted to histological and cytological descriptions of nervous tissue as such, roughly 85 pages to the morphogenesis of the nervous system, roughly 85 pages to descriptions of the "nervous organs," e. g., the cord, spinal ganglia, brain-stem, supra-segmental structures, meninges, and chorioid plexuses. The final 100 pages deal with the autonomic nervous system.

The volume, which is well written, is on the whole reasonably accurate and up to date, drawing on considerable evidence derived from experiment. It is at its best at the histological level, at its weakest in the portion devoted to the "nervous organs." Considerations of fibre-tract connections are sparse and spotty; and the limitation of discussion of the thalamus to a page and a half is hardly adequate in contemporary neurology.

Since this is a book published in France, it is worthy of mention that most of the diagrams are good and that the printing, both of text and illustrations, is beautiful. This volume is recommended reading for students and others who wish to become conversant with the structure and organization of the nervous system other than at the level of fibre-tract connections.

JANE OPPENHEIMER

THE HUMAN EYE *In Anatomical Transparencies. Explanatory text by Peter C. Kronfeld; anatomical transparencies by Gladys McHugh; historical appendix by Stephen L. Polyak. Bausch & Lomb Press, Rochester.* $6.50. xiv + 99 pp. + 16 plates; text ill. 1943.

To anyone interested in the eye, this remarkable work is indispensable. It consists primarily of 34 magnificent, detailed color plates by Gladys McHugh, arranged in two series—the right eye as seen in front view, and the right eye as seen in side view. These are reproduced at twice natural size and are arranged in a unique manner, so that the reader not only is able in effect to "dissect" the eye and adjoining structures but also to reconstruct his dissection in reverse order. The value of such a translucent, three-dimensional model arranged in planes can scarcely be overemphasized. The method should find ample and grateful application in many other fields.

Accompanying this atlas is an excellent, illustrated explanatory text by Kronfeld (70 pages), and an illustrated appendix dealing with the history of concepts relating to ocular structure and function, by Polyak (23 pages).

Not the least among the many attractions of this book is the high quality of printing and paper. The price is quite moderate.

WILLIAM L. STRAUS, JR.

THE HUMAN FACE.

By John Brophy. Prentice-Hall, New York. $3.50. vi + 250 pp. + 23 plates. 1946.

Often penetrating and never dull is this excursion by the English writer John Brophy into a subject which seems now literature, now art, which shifts to a history of fashions in beards or hair, and sweeps now and then even over the biological substrate. How like a rueful embryologist he sounds as he says: "Just the same, it is odd and inexplicable that the hair should continue to sprout from the top of a woman's head and not from her chin. But I am very glad," he adds, "that is the way of it."

In his chapter on The Marks of Time the author is particularly good. Savor the quality of his style in this passage on middle age:

"Time marches on across the face, digging in its heels as it goes, but it cannot drag the mind and the spirit at such a headlong pace. Past the milestone of maturity, we all feel younger than we look. Vitality is a rebel within the crumbling fortifications of the body: and no man is beaten till he has lost the will to fight. I am convinced that many an old man and woman dies young, and reluctant, and surprised. . . . It would make for happiness all round if the young would occasionally remember that their seniors, behind their time-betrayed faces, feel much the same as they did ten, twenty, thirty, or even the full forty Harrovian years ago, and that the irony of misrepresentation lies in comprehensive ambush waiting for those whose only care today is that they should seem more adult than they are. But then, if the young realized that, they would be no longer young."

Yet now and again John Brophy reveals that a greater knowledge of biology might have assisted his analysis. He slips sadly in his last chapter into an acceptance of Crookshank's theory of the origin of whites from chimpanzees, negroes from gorillas, and mongoloids from orang-utangs, and so is thrust into an unnecessary spiritual conflict over racial superiorities and inferiorities. He also assumes that one's native language probably modifies the vocal organs, throat, lips, and face extensively. "The Dakota-born child with Swedish parents will have lips, tongue, palate, and vocal chords adapted by long generations of inheritance to the speaking of Swedish." It is clear that Lamarckianism is fully accepted as the basis for a concept of racial inheritance altogether unsubstantiated.

But let us forget that and allow Brophy once again to show us "the human face, which remains a mystery, the frontal aspect of the topmost part of the body, a utilitarian collection of sense organs, a complex machine designed for seeing, hearing, tasting, eating, drinking, and speaking, which has also become the apocalyptic chronicle of all that passes in the mind, the heart and the spirit."

BENTLEY GLASS

ANIMAL GROWTH AND DEVELOPMENT

DIE HORMONVERSORGUNG DES FOETUS.

By Jules Samuels. E. J. Brill, Leiden. 17,50 guilders. viii + 320 pp. + 2 figures. 1947.

This volume is written with one purpose, but it may serve another equally well. It is intended primarily to advance the author's concept regarding the essentiality of gonadotropic hormone for cell division wherever it occurs throughout the animal kingdom. Actually, it presents a well organized and well annotated review of the sources, roles, and fates of hormones in the body throughout pregnancy. There are 544 reference citations. After a brief and more or less conventional statement of the different types of placentation occurring in mammals, there follows a detailed review of the hormone status throughout pregnancy of the anterior hypophysis, placenta, blood, and urine. Special emphasis is given to the situation in the human and the mare, although conditions in other species are considered as well. Differences in gonadotropic levels in these two species are ascribed to different fetal requirements, resulting from differences in placental structure and function.

If the foregoing statement appears novel to American investigators, it may be clarified by the following statement from the general conclusion: "The whole hormonal action during the gravidity chiefly serves the fetal growth." The author then goes on to say that the activation of cell division within the fetus, and so the increase in cell number, begins to take place by virtue of the increasing quantity of maternal hypophyseal gonadotropic hormone. Later, this function is taken over by the chorionic gonadotropins. Samuels simplifies his hypothesis by stating that this action only takes place after the thyrotropic hormone has acted, and that this is in reality identical with the hypophyseal luteinizing hormone and growth factors.

The literature on hormones in pregnancy is well summarized in this monograph. If, however, the author is regarded merely as having built a very tall house of cards with some of the ones at the bottom not set very straight, he has detracted greatly from the genuine worth which his treatise would otherwise have.

S. R. M. REYNOLDS

THE POSTNATAL DEVELOPMENT OF THE HUMAN CEREBRAL CORTEX. *Volume III: The Cortex of the Three-Month Infant.*

By J. LeRoy Conel. Harvard University Press, Cambridge. $12.50. x + 166 pp. + 104 plates. 1947.

The present volume is the latest of a series of studies on the development of the human cerebral cortex, with an attempt to correlate structure and function in this region of the brain. The previous volumes were concerned with the cortex at birth (vol. I) and at 1 month (vol. II). Six brains were described in volume I, 5 in volume II, and 6 in the present volume, all similarly fixed and stained by cresyl violet, Cajal silver, Golgi-Cox, and Weigert methods.

A definitive cytoarchitectural pattern is already established at birth, with 6 layers present except in certain parts of the allocortex. The structure is strikingly similar in all parts of the cortex. The cells show no discrete Nissl substance, and neurofibrils in only the largest of the Betz cells. The cells of the precentral motor cortex (area FAy of von Economo), the Betz cells in particular, are most advanced in development. Of these, the cells related to upper trunk, shoulder girdle and brachium are furthest developed. The absence of mitoses indicates that the cortex has its full quota of neurons at birth.

There is a small, gradual increase in width throughout the cortex from birth to 3 months of age, and a corresponding development of the cells (Nissl substance, neurofibrils, length and myelinization of processes). The precentral motor area remains the most advanced, particularly with respect to the cells related to the shoulder and upper arm, although those related to the hand develop rapidly. Development in other lobes of the cortex follows the frontal lobe in the following order: (1) parietal, (2) occipital, (3) temporal, and (4) gyrus cinguli and rhinencephalon. In the first three of these, the primary receptive areas for somatic sensibility, vision, and hearing are more developed than other parts of the lobes. In the premotor area of the frontal lobe, the region dealing with contralateral deviation of the eyes is most advanced. It is interesting to note that electrical potentials can be recorded at 1 month from only the precentral gyrus.

At 3 months, Nissl bodies are found in the largest Betz cells, and there is a great increase of the fibers of layer IV in the precentral motor and the primary receptive areas. Tests of behavior at 3 months are closely correlated with anatomical development, in indicating slight purposeful movements of the shoulder and arm, but not of the head, hand, or lower extremity. Slight cortical visual and acoustic functions are possible. Any cortical function appears to involve chiefly layers V and VI, possibly III and IV, but not I and II.

The author is to be congratulated on a thorough and useful series of studies. The text is carefully written and unwarranted speculation has been avoided. The plates are excellent. Enlarged drawings showing the development of the Nissl substance would help, however, in the understanding of this process. The price of the present volume ($12.50) seems rather excessive, even when one takes into account recent increases in printing costs, since the first two volumes were priced at $8.00 each.

WILLIAM L. STRAUS, JR.

ANIMAL PHYSIOLOGY

THE CHEMICAL SENSES.

By R. W. Moncrieff. Leonard Hill, London. 25s. viii + 424 pp. 1944.

There has long been a need for a book in the English language which would treat all the chemical senses as Henning's *Der Geruch* did for the olfactory sense. Moncrieff's comprehensive and detailed treatise is a notable step in this direction. Accumulated and assimilated here is a wealth of heretofore scattered information.

The subject matter, well integrated, falls into three broad categories: the biological (Chapters 1–5, 7), the chemical (Chapters 6, 8–12), and the applied (Chapters 13 and 14). The chemical sections are by far the most well done. Contained therein are outlines of the various proposed classifications of odors, an excellent exhaustive and well documented treatment of the relations between chemical constitution and odor and taste, and the physical properties of odors. The numerous theories of odor are concisely and critically presented.

Unfortunately the biological sections are less satisfactory. They discuss the structure and innervation of chemoreceptors, sensation, the phylogeny of chemical sensitivity, and such physiological aspects as adequate stimuli, fatigue, acuity, anosmia. One searches in vain, however, for much of the better recent physiological work. In the case of insects, for example, only a single paper of von Frisch's is mentioned, and no reference is to be found to Minnich's outstanding work on tarsal receptors.

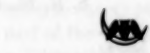
A tremendous amount of work has undoubtedly gone into assembling the facts for this book. It is of inestimable bibliographic value. One of its great services is that of illustrating how little we really know about the chemical senses and how hundreds of apparently unrelated experimental facts await assimilation. The fact that the bulk of our information deals with sensation from man's point of view rather than with stimulation treated objectively merely reflects the trend of experimental endeavor in this field.

In places the presentation is "popular" to an extreme and some of the analogies appear oversimplified, as, for example, the expansion of the analogy of stereoisomerism with right-handedness. It is regrettable that more care was not expended on the illustrations, most

of which are crude. Among minor points for criticism are the occasional capitalization of specific names and the use of lower case initials for generic names. The glossary suffers from defects comparable to those in the figures, to wit, oversimplification. Definitions of chemical terms are superior to the biological, e.g., tropism—habit of going to or away from a stimulus.

All things considered, however, Moncrieff has made a commendable contribution in a field which is admittedly very difficult. Even in the face of having to accept such *punishment* as "... hydrogen sulphide, a very bad egg olfactorily," readers interested in sensory physiology and physiological psychology will find this volume invaluable.

V. G. DETHIER

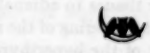


COMPARATIVE STUDIES IN THE LIGHT SENSITIVITY OF BLIND CHARACINS FROM A SERIES OF MEXICAN CAVES. *Bulletin of the American Museum of Natural History, Volume 89: Article 5.*

By C. M. Breder, Jr. and Priscilla Rasquin. American Museum of Natural History, New York. 40 cents (paper). Pp. 319–352; ill. 1947.

These experiments on the reactions of related fish from a series of caves indicate a progressive sensitivity to light from the initial river form to that of the most distant cave. On the basis of these results, together with genetic and morphologic data, the authors conclude that the populations involved worked up the now dry valley underground, and did not sink into the ground from former local surface populations in the vicinity of the caves. The picture is thus one of divergence rather than of the development of parallel but independent populations.

JOEL W. HEDGPETH



PATTERNS OF MAMMALIAN REPRODUCTION.

By S. A. Asdell. Comstock Publishing Company, Ithaca, New York. $5.00. xiv + 437 pp. + 12 plates. 1946.

This book is a significant attempt to present the many variations of reproductive physiology in mammals and to draw a general outline of mammalian reproduction based upon this extensive collection of material. Approximately 200 species, representing the major taxonomic groups, are treated in greater or lesser detail, while the inclusion in tables of forms less well known brings the number of species treated to over 900. The author has examined literature usually ignored by the physiologist, who tends to confine himself to a comparatively short list of journals. The success of the author in digging out the facts he sought from field reports shows the thoroughness with which he has attacked the problem.

An introduction of 30 pages covers a wide variety of sub-heads and forms a background for original observations based on the material that follows. This is the most readable part of the book and is also the most stimulating. The remainder is more for reference. One might object to the difference in length of the various accounts, but this it was impossible to avoid, for very little material is available on most species not usually used in the laboratory or found on the farm. The accounts are arranged in taxonomic order. Physiologists may disagree, but this arrangement seems most useful to other zoologists.

There are a few errors in the book, such as misspelling the name of an author. The book is a good example of the printers' and bookbinder's art. This is commendable, for students and research workers will give it hard use, as the standard reference work in its field.

ROBERT K. ENDERS

DIE HORMONALEN ASPEKTE DES FORTPFLANZUNGSPROZESSES.

By Jules Samuels. Holdert & Company, N.V., Amsterdam, Holland. $5.80. vi + 152 pp. 1946.

The fundamental theme of this small book is that reproductive processes, wherever they occur, have one thing in common: gonadotropic hormone activates the process of cell and egg-cell division. The presumptive biological basis of this is discussed at length throughout the three chapters of the book. After citing numerous examples of the necessity of the hypophysis for an egg cell to undergo meiosis and other situations in which there is clearly a relationship between the hypophyseal hormone and the elaboration or maturation of certain tissues, the author proceeds to attribute parthenogenesis, the mitosis of somatic cells, and the like to the "division hormone" contained within the cells.

Samuels has amassed considerable data from the literature (217 references cited) which bear on the relation of hormones to cellular proliferation throughout the the animal kingdom. For this, the reader will find this book a convenient monograph. But it will be difficult for the critical reader to follow the arguments which the author brings forth in support of his thesis.

S. R. M. REYNOLDS

PHYSIOLOGY OF MAN IN THE DESERT. *Monographs in the Physiological Sciences.*

By E. F. Adolph and associates. Interscience Publishers, New York and London. $6.50. xiv + 357 pp.; ill. 1947.

This volume is in essence the summary of a collaborative research effort carried out by E. F. Adolph and ten associates during the war. It was supported by and

for the use of the Committee on Medical Research, of OSRD. The work was carried out for the purpose of procuring as quickly as possible some practical results which would be applicable to the conduct of war activities in the desert. The results set forth here attest admirably the success of this effort.

In reality, however, this work is but a small part of the broader, important subject of what has come to be called "environmental physiology."[1] It is a type of investigation that is attracting an increasing number of physiologists, who are working in desert, arctic, and jungle climates as well as at different altitudes. Physiological studies have been carried out in the past under these conditions, but seldom have they covered the range of subjects or included the number of participating individuals which played a role in this book. Even so, it is not claimed that this is an exhaustive treatise on the subject.

In general, this volume considers the problem of the regulation of body temperatures in the desert, in particular, the question of heat exchanges, sweat formation, and water turnover. After a general orientation of the subject, it is elaborated, chapter by chapter, as the story was unfolded by studies conducted for the most part in the desert of southern California, but also in a "desert" laboratory at the University of Rochester upon men on rafts, and upon men at flight altitudes as well. Basic data are offered on rates of sweating, heat exchanges, urinary excretion rates, and fluid intake in the desert. The question of water requirements in the desert, and of water shortages and blood changes in dehydration are likewise reported. Limited observations on the circulation and temperatures of men dehydrating in heat are reported. Data and observations on the signs and symptoms of dehydration in the desert, thirst, and voluntary dehydration are presented.

The text is well supplied with climatological maps, graphs, and appendices containing additional data. Because of these facts, this volume will be of great value to physiologists in general and particularly to those engaged in studies of environmental physiology in connection with industry or the armed services.

However, the physiologist will miss in this book considerations of some of the general, basic implications of homeostatic mechanisms that operate in the organism as a whole. Again, the critical reader will wish that the data were such that the limits of tolerable stress and the physiological conditions affecting these limits might be given. For example, how exact is the figure of 20 per cent, quoted as the limit of irreversible dehydration in the human body? Will some men be much more tolerant than others? What are the functional adaptations involved in acclimatization to conditions in the desert, and how do individuals of different ages, somatotypes, and previous clinical histories react? In short, the important factors of individual variation remain largely to be established upon the excellent basic groundwork laid by this work.

One of the striking findings of this work is the interesting—and important—observation that men in the desert lose less water by sweating when clothed than when unclothed. Thus the experience of desert nomads for ages past finds here a physiological affirmation of what experience must have taught. In fact, one who has read *Seven Pillars of Wisdom* has but to recall the conduct of Lawrence of Arabia and his colleagues in their long night journeys and their attention to clothing and shelter during the daytime to comprehend what experience has taught the nomads and warriors of the desert. One must wonder, as he views the scene of current history, how much such wisdom will work for or against the divided forces that are again drawing their lines in the deserts of the Near East.

S. R. M. REYNOLDS

LA RÉGULATION HORMONALE DU MÉTABOLISME ET LA VITAMINE A.

By Michel de Visscher; preface by Léon Binet and J. P. Bouckaert. Les Editions de Visscher, Bruxelles; Masson & Cie., Paris. 250 fr. (paper). 192 pp.; text ill. 1946.

Based on an analysis of the hyperthyroid syndrome, the author advances two theses: (1) that there exists a relationship between the sympathicoadrenalin system and the thyroid hormone; (2) that vitamin A modifies this relationship. From experimental work on the basal metabolic rate of rabbits studied in a differential calorimeter and receiving various treatments, the following conclusions were derived: (a) adrenalin in physiological doses stimulates heat production; (b) this effect disappears in the thyroidectomized animal but reappears on administration of thyroid hormone; (c) these interactions occur at the tissue level, thyroid hormone sensitizing the tissues to adrenalin; (d) vitamin A causes a very slight lowering of the normal basal metabolic rate, but not of the hyperthyroid rate; (e) vitamin A prevents completely the metabolic action of adrenalin. Although the experimental section occupies a hundred pages, the total number of animals used to demonstrate at least some of these important conclusions appears to have been small, and occasionally obscure. Single protocols are sometimes given and little inkling of the normal variation to be expected, and actually encountered, can be obtained. The theoretical structure of the essay, consequently, tends to reflect back rather to the authority of the writer than to compelling experimental proof, here presented.

H. R. CATCHPOLE

PRÉCIS DE PHYSIOLOGIE.

By L.-C. Soula. Masson et Cie., Paris. 1450 fr. vi + 1085 pp.; ill. 1947.

This is an outline of physiology by the professor of this discipline on the Faculty of Medicine at Toulouse. It is written, therefore, with the point of view of a teacher, —and quite clearly of an experienced teacher. The organization of the book differs from conventional American and English texts in a number of respects. For example, instead of commencing with functional aspects of cells, especially nerve axones, and proceeding from the specific to the general, Soula commences with a consideration of the general functions of nutrition of the mammalian organism. This encompasses oxygen and nutritive requirements; digestion and absorption; followed by circulatory and respiratory mechanisms as supporting mechanisms for the former. The blood and homeostasis, and intermediary metabolism are discussed in relation to energy production and to growth. The second part of the book then deals with the functions of the integrative mechanisms of the body. These include the relation of muscle physiology, nerve muscle physiology, and the central and sympathetic nervous systems to the functioning of the body as a whole. The rationale of this organization is fully justified by the logical development and exposition of an admittedly large and complex subject.

This treatment of the subject imposes of necessity several limitations which American readers will notice at once; yet they are clearly justified by the logic of the organization. The subject of the ductless glands is not taken up in any one place, but is treated throughout the numerous parts of physiology to which this subject is related. Thus the thyroid and adrenal glands are discussed in relation to energy production, the pancreas in relation to carbohydrate metabolism, the gonads, parathyroids, and so forth to morphogenetic development.

If the treatment of many topics is superficial, as indeed it is, this is more than made up by the scope of this book, and the logical development of the subject as a whole.

The volume is dedicated to the late Professor Sherrington.

S. R. M. Reynolds

ANIMAL NUTRITION

Animal Nutrition. *McGraw-Hill Publications in the Agricultural Sciences. Second Edition.* *By Leonard A. Maynard. McGraw-Hill Book Company, New York and London.* $5.00. xviii + 494 pp.; ill. 1947.

The author is an outstanding investigator and teacher in the field of animal nutrition, and his knowledge and experience are reflected throughout this excellent textbook for students of agriculture. The objective was to present the principles of nutrition and their applications in feeding practice. The subject is presented from the biochemical standpoint, and basic principles are discussed clearly. Nine years have elapsed since the appearance of the first edition. The author has now incorporated, with great economy of words, a large amount of new material based upon the researches of recent years. The book can be highly recommended as a student textbook and for farmers who have taken a degree in agriculture.

E. V. McCollum

Calcium and Phosphorus in Foods and Nutrition. *By Henry C. Sherman. Columbia University Press, New York.* $2.75. x + 176 pp. + 1 plate. 1947.

Calcium and phosphorus overshadow all other inorganic elements of physiological significance in the amounts which occur in the body. It is therefore appropriate to discuss these elements apart from other essential nutrients in their various biochemical functions. The titles of the seven chapters in the present book are: Background of the calcium and phosphorus problems in nutrition; Calcium in the body; Effects of food and growth upon the calcium content of the body; Chemical forms and nutritional functions of phosphorus in the body; Calcium and phosphorus requirements; The problems of the necessary and optimal intakes; Foods as factors in the nutritional provision of calcium and phosphorus; and Summary and suggestions. There is a selected bibliography, and an Index. In 115 pages the author has presented a digest of data and interpretations derived from the bibliography of about 500 journal references. The book will serve admirably the needs of teachers of nutrition and physiology, and as a handy reference to publications describing the principal researches relating to calcium and phosphorus in physiological processes. A knowledge of biochemistry and physiology will be necessary for an appreciation of the book.

E. V. McCollum

Studies on the Nature of the Bromate Effect. *By Holger Jørgensen. Einar Munksgaard, Copenhagen; Humphrey Milford, Oxford University Press, London.* 40s. or 40 Dan. cr. 435 pp.; ill. 1945.

The author is chief of the research department of the Dansk Gaerings-Industri, Ltd. of Copenhagen. The present English translation of the original Danish edition presents, in its earlier chapters, an excellent discussion of baking strength in flour as affected by various additions to the dough. The greater part of the book is devoted to descriptions of the experimental methods of studies in which numerous substances were added in small amounts to dough, and of the results obtained. The objective of the studies was to discover

the nature of the remarkable bromate effect so highly valued by bakers everywhere. The book is a scholarly work and should be read by every chemist who desires to know about the chemistry of flour and of baking processes. It is the best work available on the subject, as far as the present reviewer is aware.

E. V. McCollum

BIOCHEMISTRY

Dynamic Aspects of Biochemistry.

By Ernest Baldwin. Cambridge, at the University Press; Macmillan Company, New York. $4.00. xvi + 422 pp. 1946.

Biochemistry is the science which deals with the chemical processes occurring in living organisms and in interpreting aspects of biological function in chemical terms. In spite of the remarkable achievements of biochemistry, this broad aspect of the science has been obscured by our university courses, textbooks, and journals, which have been primarily concerned with clinical chemistry. Perhaps the current interest in microbiology, biochemical genetics, and cytochemistry may serve to bring recognition to general biochemistry as an academic discipline.

The development of general biochemistry will be greatly aided by a useful and readable book dealing with the chemical processes in cells and their mediation by enzymatic systems. Baldwin has now written such a book, and his title is well chosen. He is careful to distinguish between the organic chemistry of naturally occurring compounds, as the necessary foundation of biochemistry, and the dynamic changes which these compounds undergo within living organisms, and the biological consequences of these reactions. This latter, or dynamic aspect, is the one Baldwin emphasizes as the real subject matter of biochemistry.

This book should be of value not only to students studying biochemistry, but to all graduate students in biology and to many in chemistry. In fact, many mature biologists will spend a profitable and pleasurable evening with this book. The technical knowledge required for its reading is slight. The number of specific literature references is few, and yet the examples chosen to illustrate the points made are fairly widely selected from the fields of biology. Although Baldwin states that he wrote the book as a textbook for students studying non-medical biochemistry, he commands a lightness of style and a verve not found in the usual textbook.

Part I deals with enzymes and the nature of the catalytic process, and has chapters on hydrolytic, phosphorylytic, and oxidizing enzymes. Part II contains 11 chapters that deal with metabolism. The treatment is straightforward, easily comprehended, and written with an advanced student in mind as reader. On the whole, it is modern, but conventional. The treatment of catalysis is classical, the kinetic treatment essentially non-mathmatical, and perhaps both too conventional and too simple.

The reviewer would have liked to see a much fuller treatment of nucleoproteins and their role in chromosomes, viruses, etc., and more attention given to cytochemistry and to chemical changes in relation to growth and differentiation. Plant biochemistry is largely omitted from this volume; and photosynthesis, one of the most intriguing of all biochemical reactions, is entirely omitted, as is nitrogen fixation also. Although this book consequently fails to fill the need for a truly general biochemistry, it deserves to be successful, and is definitely oriented in the right direction. Biochemistry has not yet found its Bayliss, just as physiology seems unable to produce a second one.

David R. Goddard

Currents in Biochemical Research: *Thirty-one essays charting the present course of Biochemical Research and considering the intimate relationship of biochemistry to medicine, agriculture and social problems. Edited by David E. Green. Interscience Publishers, New York.* $5.00. viii + 486 pp. 1946.

The primary purpose of the volume, according to the editor's preface, is to provide a perspective which could assist biochemists, as well as non-biochemists, to arrive at a proper estimation of the relation of biochemistry to other fields of investigation. It is also proposed to provide for research workers the opportunity "to describe in as simple a language as possible the important developments in their own fields and to speculate a little on the most likely paths of future progress."

The volume consists of 31 essays ranging from The Gene and Biochemistry (G. W. Beadle) to Social Aspects of Nutrition (W. H. Sebrell). It therefore covers a wide variety of subjects and viewpoints. There are, however, a few surprising omissions. For example, the recent advances in our knowledge of polysaccharide synthesis, with its broad implications for biological synthesis in general, is hardly discussed adequately. The spectacular advances in the bacterial viruses of the last few years are only mentioned in passing.

Biologists should read this book not alone for the wealth of factual material contained in it. More important perhaps is the insight into the attitudes and methodology of their biochemical colleagues in the analysis of common problems.

It is inevitable that the present volume should be compared with the earlier *Perspectives in Biochemistry*, which had a similar purpose. On the whole it must be admitted that *Currents in Biochemical Research* suffers

by the comparison. It fails to arrive at the levels of excitement attained by the authors of the previous volume. For the most part, the present essayists have failed to take the opportunity provided by the editor "to speculate a little"; or if they did, they took his invitation for a warning.

In view of some of the omissions, it is difficult to avoid noticing the peculiar geographical distribution of the essayists. One is tempted to rename the book to "Currents in Biochemistry in and around New York."

S. SPIEGELMAN

ANNUAL REVIEW OF BIOCHEMISTRY. *Volume XVI. Edited by J. Murray Luck, Hubert S. Loring, and Gordon Mackinney. Annual Reviews, Stanford University P. O., California.* $6.00. xii + 740 pp. 1947.

The task of reviewing a group of reviews such as this always brings one face to face with the limitations of the individual in this age of specialization. This is the fact that one can only develop experience, understanding, and a vocabulary, in one, or at the most a few, of the special fields. It is the recognition of this fact that has stimulated annual reviews such as this. They are reviews written by experts in a field, to be read by others specializing in related and other fields. While the chapter headings change little from year to year, the reviews are protected from monotony and redundancy by a system of changing reviewers each year. Thus there is opportunity for placing emphasis on that part of the field in which the reviewer is interested and to which he has contributed. As a result, the chapter on any given subject one year may not be concerned with the same group of substances that were discussed in the chapters with similar titles in previous years. Biologists will do well to form a habit of browsing through these authoritative reviews each year to keep in touch with advances in their own and related fields.

The first chapter, by Michaelis, is an excellent example of the above statements. In this chapter the major advances made in the field of biological oxidations and reductions during the preceding year have been discussed. At times, one receives the impression that the review is little more than an annotated bibliography, but in the numerous places which coincide with the author's own interests there is displayed the unmistakable stamp of an authority who has contributed to the basic problems of this field. This requires, in addition to the ability to evaluate critically the advances, pointing up the unsolved problems.

It would be presumptuous of a reviewer to be critical in a specific way of most of the reviews in this series. It would also be futile and require too much space to attempt to give a summary of all the chapters and subjects covered. This review will therefore be limited to a mere mention of some of the chapters and some discussion of the content of chapters that appear to be timely and of special interest to biologists. This year's volume contains 25 reviews which average 26 pages each. The author index lists approximately 4300 names, and the subject index, which fills 23 pages, lists over 2500 items.

As in previous years, there are chapters on proteolytic enzymes, carbohydrates, lipids, phosphorus compounds, carbohydrate metabolism, and the metabolism of proteins and amino acids. In the chapter on fat soluble vitamins, Embree has summarized the recent work on the synthesis of vitamin A or compounds resembling vitamin A and has discussed the biological activity of these compounds. The chapter on water-soluble vitamins by Woolley discusses the broad fundamental advances made in 1946. Of these, the elucidation of the structure of folic acid and the use of this substance in the treatment of pernicious and other anemias appear to have been the most outstanding. Another very significant discovery was that the proteins in the time-honored "vitamin free casein" contain an essential nutritive factor which is not an amino acid, and hence supply more than the essential amino acids in experimental diets. The chapter on animal pigments in this volume concerns itself with a discussion of carotenoid and indolic biochromes. The reviews on the nitrogenous constituents of plants and the mineral nutrition of plants may be of interest to those in the botanical specialties. The relatively long and comprehensive review of growth substances in higher plants, by Skoog, will provide much food for thought, not only for botanists but also for those interested in problems of growth in general.

The chapter which is most timely and which will undoubtedly prove to be of great current interest to biologists is the one on the fundamental aspects of the use of isotopes in biochemical research. In 21 pages Kamen has presented the basic considerations and, what is just as important, some of the limitations of the use of isotopic tracer techniques. While this chapter cannot compare with the more recently published book on this subject by the same author, it is a masterly presentation of the subject.

FRANK H. J. FIGGE

APERÇUS SUR LES PROGRÈS DE LA BIOCHIMIE, DANS LES PAYS ANGLO-SAXONS, DEPUIS 1940. *Actualités Biochimiques, Number 1.*

By Marcel Florkin. Éditions Desoer, Liege; Masson et Cie., Paris. 200 fr. (paper). 77 pp. 1945.

DONNÉES RÉCENTES SUR LA NATURE ET LE MÉTABOLISME DE L'OS. *Actualités Biochimiques, Number 2.*

By Marcel J. Dallemagne. Éditions Desoer, Liege;

Masson et Cie., Paris. 200 fr. (paper). 68 pp. 1945.

L'ÉVOLUTION DU MÉTABOLISME DES SUBSTANCES AZOTÉES CHEZ LES ANIMAUX. *Actualités Biochimiques, Number 3.*

By Marcel Florkin. Éditions Desoer, Liege; Masson et Cie., Paris. 200 fr. (paper). 66 pp. 1945.

MÉTHODES NOUVELLES D'ANALYSE BIOCHIMIQUE ET CLINIQUE (*I^re^ série*). *Actualités Biochimiques, Number 4.*

By Ghislaine Duchateau. Éditions Desoer, Liege; Masson et Cie., Paris. 140 fr. (paper). 63 pp. 1946.

DONNÉES RÉCENTES SUR LA COAGULATION DU SANG. *Actualités Biochimiques, Number 5.*

By Pierre Fredericq. Éditions Desoer, Liege; Masson et Cie., Paris. 140 fr. (paper). 63 pp. 1946.

ACQUISITIONS RÉCENTES DANS LE DOMAINE DE L'ENZYMOLOGIE. *Actualités Biochimiques, Number 6.*

By L. Massart. Éditions Desoer, Liege; Masson et Cie., Paris. 140 fr. (paper). 62 pp. 1946.

CONCEPTION ACTUELLE DU CATABOLISME DE L'HÉMOGLOBINE. *Actualités Biochimiques, Number 7.*

By Claude Liébecq. Éditions Desoer, Liege; Masson et Cie., Paris. 140 fr. (paper). 64 pp. 1946.

These seven pamphlets are the initial numbers in a series of reviews published under the direction of Marcel Florkin, and are intended to provide a summary of current progress and trends in special aspects of biochemistry and physiology. There is much to be said for the publication of reviews in this form, rather than as collections in journals or bound volumes. It is inexpensive, and any worker can secure just those reviews of most interest to him. On the other hand, it may lead to a narrowing of interest that in time would be unfortunate. Yet the advantages seem to outweigh the disadvantages, and the plan may be recommended to the consideration of American editors and publishers, who seem bent on bringing out every year more and more expensive volumes of reviews.

BENTLEY GLASS

COLLOIDS: *Their Properties and Applications. Blackie's "Technique" Series.*

By A. G. Ward. Interscience Publishers, New York. $1.75. x + 133 pp. + 6 plates. 1946.

This is a simple book, but nevertheless an effective one. As a non-specialist in the field the reviewer felt, as he turned the pages, that the author had firmly taken him by the hand and was giving him a personally conducted tour of the world of colloids. This world is a large one and, as the author points out, an important one, for not only are colloids of fundamental importance in many technological processes, but they are also basic in the functioning of living organisms. It is indeed surprising how much valuable information can be presented in 130 small, printed pages. Many important things have been left out and no subject is treated in detail, but this always needs to be true of a book of this sort.

The cover bears the words: "A simple account of the physics and chemistry of colloids, with their many applications in physics, engineering, geology, biology." The author has clearly accomplished what he set out to do.

I. FANKUCHEN

VITAMINS AND HORMONES. *Advance in Research and Applications. Volume IV.*

Edited by Robert S. Harris and Kenneth V. Thimann. Academic Press, New York. $6.80. xviii + 406 pp. 1946.

H. A. Schneider has contributed to this volume a model review in a difficult field—the "strategic situation" in nutrition and resistance to infection—with some pertinent remarks on the nature of reviews themselves. Clements's article on nutritional deficiency in infants nicely supplements Warkany's account last year of the prenatal deficiencies. Thayer covers the field of the bioassay of animal hormones in a generally useful article. Reviews may suffer from over-topicality, in a subject where advances are rapid, and this seems to be the case with the hematopoietic factors (Pfiffner and Hogan). Until chemically defined substances emerge from the welter of such factors of the B-complex (a process that seems to have started with the isolation of pteroylglutamic acid), the general reader may well feel stranded in a terminological jungle. Conclusions reached by Houssay (the thyroid and diabetes) and Hertz (effect of B-vitamins on reproduction) are largely tentative.

Other contents: Nutritional therapy of endocrine disturbances (Biskind); Thyroactive iodinated proteins (Reinke); The protein anabolic effects of steroid hormones (Kochakian).

This volume maintains the high standards previously set by the editors.

H. R. CATCHPOLE

CHEMISTRY AND PHYSIOLOGY OF THE VITAMINS. *Revised reprint.*

By H. R. Rosenberg. Interscience Publishers, New York. $7.50. xiv + 676 pp. 1945.

RECENT PROGRESS IN HORMONE RESEARCH. *Proceedings of the Laurentian Hormone Conference. Volume I.*

Edited by Gregory Pincus. Academic Press, New York. $7.50. vi + 399 pp.; text ill. 1947.

This book is a handsomely produced record of papers given at the Laurentian Hormone Conference in the late summer of 1945. It is the first volume of an annual series and comes with a roster of distinguished contributors. One's natural welcome to a new periodical may be tempered by such questions, (among others) as: Does it specifically contribute a fresh medium not elsewhere available for the dissemination of new scientific knowledge or new syntheses of such knowledge? Does it command international coverage in respect of contributors? As regards the first, there is already in the field *Vitamins and Hormones*, with which the subject matter of the present volume partly overlaps. On the other hand, Volume I of *Recent Progress in Hormone Research* includes articles ranging from pure chemistry to experimental pathology. With regard to the second question raised, the make-up of a regional conference may work against an international participation except within this (northern) hemisphere; however, 1945 was an abnormal year, and it is possible that this situation may already have changed in the direction of a more general representation of the field of hormone research.

The contents are as follows: Neurohumoral relationships: On the role of acetylcholine in the mechanism of nerve activity (Nachmanson); Hormones and mating in behavior (Beach).

Chemistry and physiology of adrenal hormones: Steroids derived from the bile acids (Kendall); Some advances in the partial synthesis of adrenal cortical steroids (Gallagher); The relationship of cholesterol and ascorbic acid to the secretion of the adrenal cortex (Long); Studies of the role of the adrenal cortex in the stress of human subjects (Pincus).

The role of hormones in metabolic processes: The relation of the anterior pituitary hormones to nutrition (Samuels); The role of hydrolytic enzymes in some of the metabolic activities of steroid hormones (Kochakian); Studies on steroid hormones in experimental carcinogenesis (Gardner).

Aspects of clinical endocrinology: Endocrine aspects of human cancer (Nathanson); The effects of hormones on osteogenesis in man (Albright); Certain factors which influence the rate of growth and the duration of growth of children (Talbot and Sobel); Experimental renal hypertension with special reference to its endocrine aspects (Grollman).

H. R. CATCHPOLE

CHEMISTRY OF MUSCULAR CONTRACTION.

By A. Szent-Györgyi. Academic Press, New York. $4.50. viii + 150 pp.; ill. 1947.

The present book represents an outgrowth of the Cameron Prize Lecture which Szent-Györgyi gave at Edinburgh in 1946. It is an unusual and stimulating presentation on the chemistry of muscle contraction. It covers primarily the previously unpublished observations which were made during the war years by the author and his colleagues. The new and in many cases quite speculative ideas about muscle contraction will obviously stimulate a great deal of experimentation.

The book is divided into five parts, of which the first is concerned with Myosin, Actin, and Actomyosin and the second with the Conditions and Reactions in Muscle. Part IV presents the advancements in the period 1946–47 and qualifies and re-emphasizes certain of the viewpoints presented in the earlier two sections.

In Part III the author presents his Continuum Theory, a highly interesting but speculative idea concerning band spectra in protein complexes. This theory is concerned primarily with the pooling of valency electrons in complexes of molecules to form a sort of continuum along which the electrons may travel. In this case the valency electrons become the property of the whole system rather than that of a single atom. The experimental support for such a theory comes primarily from observations on the phosphorescence of gelatin phosphors.

Part V is concerned with methods and is probably the most important section for the research worker. In this part the author describes the methods employed in his laboratory for the preparation of adenosine triphosphate in large quantities, and for the isolation of myosin, actin, and actomyosin threads.

Szent-Györgyi's book will certainly be received enthusiastically by all those interested in the physiology of muscle contraction and related subjects.

W. D. MCELROY

SURVEY OF CONTEMPORARY KNOWLEDGE OF BIOGEOCHEMISTRY. *1. Isotopic Phenomena in Biogeochemistry. Bulletin of the American Museum of Natural History, Volume 87, Article 2.*

By Martin D. Kamen. American Museum of Natural History, New York. 35 cents (paper). Pp. 101–138; 3 figs. 1946.

"All of the available evidence on isotope effects in the biosphere is (here) collected and discussed. . . . There is a paucity of reliable data on geochemical isotopes. . . . The special role of biological systems in affecting isotope separations still remains to be established. Preliminary data already reveal such effects for hydrogen, oxygen, and carbon, and perhaps potassium."

BIBLIOGRAPHY OF REFERENCES TO THE LITERATURE ON THE MINOR ELEMENTS AND THEIR RELATION TO

PLANT AND ANIMAL NUTRITION. *Seventh Supplement to the Third Edition.*

Compiled and published by the Chilean Nitrate Educational Bureau, New York. Free upon request. (paper). 121 pp. 1947.

Abstracts, author and subject indices.

REPORTS OF THE BIOCHEMICAL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. *Volume VIII, 1944–1945. With an Index to BRF Publications Nos. 1 to 212 and BRF Notes November 1938 to December 1945. Collected Papers. Biochemical Research Foundation, Newark, Delaware.* $3.00. [1947].

MICROBIOLOGY

AN INTRODUCTION TO BACTERIOLOGICAL CHEMISTRY. *Second Edition.*

By C. G. Anderson. A William Wood Book; The Williams & Wilkins Company, Baltimore. $5.00. x + 500 pp. + 1 chart; text ill. 1946.

The second edition of this textbook has been enlarged by the addition of two new chapters dealing with chemotherapy and antibiotics, as well as by sundry insertions elsewhere. It still remains a poor piece of work, confused, out of date, and replete with factual errors. The confusion is well illustrated by the treatment accorded to those respiratory processes employing extraneous hydrogen acceptors other than free oxygen. Of the three most important examples, carbonate reduction (methane formation) is handled along with the totally different process of methane oxidation in the chapter on autotrophic nutrition, nitrate reduction is mentioned in passing in the chapter on respiration, and sulfate reduction is completely ignored. The out-of-dateness appears with painful clarity in the theoretical discussions, particularly in those pertaining to the mechanisms of carbohydrate breakdown and the assimilation of carbon dioxide by autotrophs, where hypotheses that were laid to rest ten years ago are resurrected and made to pass for current concepts. Kluyver's speculations on the intermediate steps in the various bacterial fermentations were brilliantly ingenious and stimulating in 1931, but one hardly expects to find them presented unaltered in a book published fifteen years later. The factual errors are often inexplicable: for example, a hopelessly confused and incorrect classification of the lactic acid bacteria (p. 318) is alleged by the author to represent the system of Orla-Jensen. It is unfortunate that this book was published, and one can only hope that no student will be encouraged to read it.

R. Y. STANIER

DIE ERNÄHRUNGSPHYSIOLOGISCHE BEDEUTUNG DER HEFE. *Beihefte zur Zeitschrift für Vitaminforschung, Nr. 4.*

By J. C. Somogyi. Hans Huber, Bern. Schw. Fr. 6–110 pp. 1944.

It would be difficult to overemphasize the importance of the role played by yeast in the remarkable advances of the last decade in the physiology and biochemistry of the cell. As a result of all this activity more is probably known and understood about the yeast cell than about any other unit of living matter. Unfortunately, much of this material is scattered in the biochemical literature. Somogyi has made a modest but extremely useful attempt to gather some of this information together into one monograph. Starting out with the histology of the yeast cell, he covers such topics as organic and inorganic composition, vitamin content, amino acid and protein composition, as well as methods of growing yeast. He also considers the functional biochemical properties of dried yeast as well as yeast extracts.

There is little doubt that this small monograph will be found by most to be a useful collection of desirable information. It is unfortunate that the added effort required for indexing was not expended.

S. SPIEGELMAN

PARASITOLOGY

AN ILLUSTRATED LABORATORY MANUAL OF PARASITOLOGY. *Revised Edition.*

By Raymond M. Cable. Burgess Publishing Company, Minneapolis. $1.65 (paper). vi + 112 pp.; ill. 1943.

This manual should prove to be a very valuable laboratory guide to the parasitology student. Although it was originally designed for the author's courses in this subject, it no doubt can be adapted to many similar courses given in other institutions. The manual is organized in such a logical fashion that other instructors could easily arrange their laboratory sessions to coincide with the sequence presented in the manual.

The author has emphasized the parasites of medical importance; however, other organisms have been included to make it a well rounded manual in general parasitology. The text is well written and includes many pertinent questions that should stimulate the student. The most attractive and valuable feature of the manual is its illustration. Practically every organism discussed is illustrated by a clear drawing. Most of the illustrations are fully labeled, enabling the student to grasp easily the meaning of the text. Although in general the hundred-odd illustrations are excellent, the one of the malarial parasites should be corrected. It is so labeled that it implies that only the immature schizonts of *P. falciparum* are not usually seen in the peripheral blood.

The manual concludes with a rather complete section on laboratory techniques applied to parasi-

tology. The offset printing is much clearer than the mimeographed type of the earlier edition. The manual possesses an index and a list of selected references.

M. M. BROOKE

MOSQUITOES OF OKINAWA AND ISLANDS IN THE CENTRAL PACIFIC. *NavMed 1055.*

By Richard M. Bohart and Robert L. Ingram. Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Free upon request (paper). ii + 110 pp.; ill. [No date.]

The title indicates the main contents of the publication. There is a general introduction describing the collections studied, their sources, and giving notes on technique. The following areas are treated separately: Hawaiian Islands (4 species), Samoa (8 species), Marshall Islands (4 species), Caroline Islands (14 species, of which 3 are described as new, and 4 are placed only in the genus but not described), Mariana Islands (12 species, of which one is a new species and one a new subspecies), Okinawa (33 species, of which 1 is a new species). Keys to adults and larvae are given. Notes on distribution, biology, and relation to disease are summarized under each species. This is a useful summary for those working in the Central Pacific area, as the publication is well illustrated.

R. MATHESON

THE MOSQUITOES OF JAPAN AND THEIR MEDICAL IMPORTANCE. *NavMed 1095.*

By Tsai-Yu Hsiao and Richard M. Bohart. Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Free upon request (paper). iv + 44 pp. + 3 plates. 1946.

This publication gives keys to the adults and larvae of 44 known Japanese species. Each species is also treated separately by brief notes (and frequently full descriptions of species) on their distribution, biology, and relation to disease. An added section gives a condensed account of filariasis, Japanese "B" encephalitis, malaria, dengue, and yellow fever in Japan, with detailed statements of the known mosquito vectors. No yellow fever is known to occur in Japan. There is also a valuable bibliography. As most of the work on Japanese mosquitoes is in the Japanese language, this publication is of importance to all workers interested in the fauna of Japan.

R. MATHESON

ATLAS DES PARASITES DES CULTURES. *I. Lutte Antiparasitaire: Orthoptères, Hémiptères, Névroptères, Lépidoptères. II. Coléoptères, Hyménoptères, Diptères, Autres Ravageurs.*

By Raymond Poutiers; preface by R. Jeannel; illustrated by Bernard Couturier. Éditions N. Boubée & Cie., Paris. (I) 250 fr. (paper); (II) 250 fr. (paper). (I) 139 pp. + 12 plates; text ill. (II) 129 pp. + 12 plates; text ill. (I) 1945; (II) 1947.

As stated in the introduction, the purpose of these volumes is to make known in limited space the agents responsible for crop damage, the methods of control, and the interrelationships of plants and plant pests. This purpose is most satisfactorily fulfilled. Gathered here is pertinent and interesting information, presented in a manner which will please and benefit the professional and amateur farmer confronted with insect or rodent control problems. Inasmuch as the subject matter deals with agricultural problems in France, these volumes will excite only limited interest in this country. On the other hand, they are excellent examples of what can be done by way of presenting the public with attractive as well as informative accounts of crop pests.

Volume I introduces the reader to natural and artificial methods of control. The following orders of insects are then discussed: Orthoptera, Dermaptera, Isoptera, Odonata, Hemiptera, Neuroptera, Thysanoptera, Lepidoptera. Volume 2 considers the Coleoptera, Hymenoptera, Diptera, myriapods, arachnids, nematodes, molluscs, birds, and rodents. For each there is given a brief accurate description, an indication of damage done to crops, and up-to-date methods of control. Items of academic interest are held to a minimum. For example, metamorphosis is treated only in so far as it will aid in identification or in an understanding of control.

Of more than passing interest is a brief account of the exchange of pests between New and Old Worlds. It may come as a surprise to some to learn that in exchange for the gypsy moth, European cornborer, etc., we have given Europe the Colorado potato beetle, San José scale, and other pests.

The colored illustrations are not only beautiful but of very definite assistance in the recognition of the various pests. The neat caricatures at the ends of each chapter lend an amusing air to the whole. An American counterpart to these little volumes would be an asset to economic entomology in this country.

V. G. DETHIER

HEALTH AND DISEASE

THE HEALTH OF THE SCHOOL CHILD.

By Gertrude E. Cromwell. W. B. Saunders Company, Philadelphia and London. $2.50. xii + 256 pp.; ill. 1946.

A nursing supervisor of the Des Moines Public Schools has here written lucidly and sympathetically of the health problems of children and the role of the school

nurse in the school health program. This is a non-technical presentation of the responsibilities and duties of the nurse, both within and outside of the school building. Some of the common deficiencies and inadequacies of systems in force at the present time, such as poor follow-up of the medical appraisal, are pointed out. The importance of the educational aspects of health programs is emphasized.

HARRIETTE D. VERA

SCHOOL HEALTH PROBLEMS *With an Outline on School Health Administration. Third Edition.*

By Laurence B. Chenoweth and Theodore K. Selkirk; outlined by Richard Arthur Bolt. F. S. Crofts & Company, New York. $3.00. xii + 419 pp.; ill. 1947.

Broad in scope, modern in point of view, both practical and scientific, this book which proposes to "acquaint students, teachers and others interested with the general nature of school health problems," is considerably better than many publications in its field. Moreover, its size has been kept within reasonable bounds, considering the many aspects and problems involved in such a subject.

About a fourth of the text is devoted to a well written discussion of growth and nutrition. There are two chapters on the physical examination, but they are not too detailed, and this is not a book for a school medical staff. Other topics are covered more briefly. A teacher might be better informed by a slightly different selection of material, e.g., by a more extensive consideration of health teaching and a less technical handling of the subject of endocrine glands.

Some of the more recent developments in knowledge concerning child health have been mentioned or discussed. Yet one could wish, especially in view of the generally high calibre of the book, that this third edition had been more completely revised. Particularly is this true of the chapter bibliographies, for they consist largely of references ten to twenty or more years old.

HARRIETTE D. VERA

WELL AND HAPPY. *Health of Our Nation, Book One. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.08. 156 pp. ill. 1942.

CLEAN AND STRONG. *Health of Our Nation, Book Two. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.12. 180 pp.; ill. 1942.

FIT AND READY. *Health of Our Nation, Book Three. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.24. 243 pp.; ill. 1942.

SAFE AND SOUND. *Health of Our Nation, Book Four. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.28. 279 pp.; ill. 1946.

HALE AND HEARTY. *Health of Our Nation, Book Five. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.32. 303 pp.; ill. 1943.

ACTIVE AND ALERT. *Health of Our Nation, Book Six. By Clifford Lee Brownell and Jesse Feiring Williams.* $1.36. 311 pp.; ill. 1943.

LIVING AND DOING. *Health of Our Nation, Book Seven.*

By Clifford Lee Brownell and Jesse Feiring Williams. $1.40. vi + 346 pp.; ill. 1943.

TRAINING FOR LIVING. *Health of Our Nation, Book Eight.*

By Clifford Lee Brownell and Jesse Feiring Williams. $1.44. iv + 347 pp.; ill. 1943.

THE HUMAN BODY: *How It is Built and How it Works. Health of Our Nation Series.*

By Clifford Lee Brownell and Jesse Feiring Williams. $1.60. x + 310 pp.; ill. 1946.

HEALTH PROBLEMS: *How to Solve Them. Health of Our Nation Series.*

By Clifford Lee Brownell, Jesse Feiring Williams, and William Leonard Hughes. $1.96. x + 317 pp.; ill. 1942.

BEING ALIVE: *Human Structure and Functions. Health of Our Nation Series.*

By Clifford Lee Brownell, Jesse Feiring Williams, and William Leonard Hughes. $1.96. x + 430 pp.; ill. 1942.

ADVENTURES IN GROWING UP. *Health of Our Nation Series.*

By Clifford Lee Brownell, Jesse Feiring Williams, Katherine M. Conrad, Ruth Evans, A. Abbott Kaplan, Jeanie M. Pinckney, and Dorothy N. Ruff. $1.96. viii + 488 pp.; ill. 1941.

YOUTH FACES MATURITY: *Health Problems. Health of Our Nation Series.*

By Clifford Lee Brownell, Jesse Feiring Williams, and William Leonard Hughes. 20 cents (paper). 30 pp. 1942.

American Book Company, New York, Cincinnati, Chicago, Boston, Atlanta, Dallas, and San Francisco.

Bright and colorful in appearance, attractively illustrated, well written, carefully graded in difficulty, this series of hygiene books appears to have every feature of merit present-day textbook-makers can offer.

Yet they arouse two questions of grave concern in educational matters. In the first place, is this imposing weight of indoctrination about toothbrushes and the proper handling of sneezes really necessary? and must it be thus repeated year after year, in order to be effective? The first three books may be written off as attractive little readers that might just as well be about any other interesting subject, for the few simple hygienic instructions they contain can, in any case, be

taught best by oral precept and by example. The books for the middle and higher grades repeat the same material, year after year, with gradually increasing depth and scope. One good book at the fourth or fifth grade level, and another at the ninth or tenth would cover all the subject matter of human anatomy and physiology, diseases, hygiene, and safety precautions, and leave the remaining years free for other important subjects. Isn't the curriculum overcrowded without all this repetition? And wouldn't the increased interest due to the freshness of the subject, if taught only twice in this span of years, more than make up for any value of repetition in learning, especially when the repetition is carried to the risk of boredom?

The second question is of even greater importance. This series, like all others of its sort the reviewer has seen, completely shuns any consideration of reproduction and sex education. A slender, unillustrated pamphlet on these matters is, to be sure, provided with the higher books in the series, for use if the teacher so desires. But it is altogether inadequate. It is high time we awoke to our responsibility in this direction. Many, if not a majority, of the users of these books will leave school, marry, and raise families with no further instruction in such matters. The boys are already in early adolescence, at the maxima of their sexual activities (see the review of Kinsey, Pomeroy, and Martin: *Sexual Behavior in the Human Male*, in this issue, p. 39); while the young girls are faced with the puzzling inner sexual conflict between mature physique and immature emotions. These facts add up to a conclusion now quite generally accepted among leaders of sex education, viz., such instruction should be planned to begin in the middle grades, before the children reach that age when embarrassment makes it difficult to teach them about sex. Only the persistent Victorian attitudes toward sex keep us from an intelligent and vigorous effort to revolutionize this aspect of our education.

BENTLEY GLASS

HEALTH FACTS FOR COLLEGE STUDENTS: *A Textbook of Individual and Community Health. Fifth Edition.* *By Maude Lee Etheredge. W. B. Saunders Company, Philadelphia and London.* $2.50. xiv + 439 pp.; ill. 1947.

This is a highly informative and comprehensive presentation of the subject of hygiene. At the same time it is not very detailed or technical and should be readily understood by college or senior high school students having little or no previous knowledge of the subject. A good share of the book deals with personal hygiene, and enough anatomy is included to provide a sound basis. Pertinent information on public health aspects has been incorporated throughout, and there is a separate chapter entitled Supervision of Health, and another on Housing.

In this fifth edition since the first printing of the textbook in 1933, a real effort has been made to keep the text up to date. For example, epidemiological statistics are recent ones, and the Rh factor and the relation of fluorine to dental caries are discussed. The bibliography has also been revised to cover recent publications.

Illustrations are not numerous; they consist of charts, diagrams, and graphs. At the ends of the chapters are lists of subjects or questions for class discussion. At the end of the book are a list of films appropriate for classroom use and an index.

HARRIETTE D. VERA

DISEASES TRANSMITTED FROM ANIMALS TO MAN. *Third Edition.*

By Thomas G. Hull. Charles C. Thomas, Springfield, Illinois. $10.50. xviii + 571 pp.; ill. 1947.

The voluntary association of man with friendly and beneficial animals, as well as his unwanted contacts with other animals, has tended to jeopardize man's health. There are many diseases that are shared by animals and man and others that are passively transferred from man to man by way of animals. This book is concerned with these diseases.

All types of pathogens are considered here: viruses, bacteria, fungi, protozoa, and helminths. They are presented under four major sections: Diseases of Domestic Animals and Birds; Diseases of Rodents and Wild Animals; Human Diseases Spread by Animals; and Animals as Passive Carriers of Disease Organisms. A final chapter summarizes the role played by each animal in the spread of disease.

Although Hull and fourteen contributors have written various parts of the book, each chapter has essentially the same organization. Brief historical accounts of the diseases are followed by thorough discussions of their epidemiology and prevention. At the end of each chapter is a helpful pseudo-summary entitled Items of Note.

The list of contributors includes many important men in the fields of public health and veterinary medicine. The author has been careful to give them full credit for their contributions, acknowledgment being made at the beginning of each such chapter to its author.

This is the third edition of the book, first published in 1930. It has undergone many changes with the advent of new information pertaining to the subject. In comparing the present edition with the second, it is obvious that it has been substantially enlarged and improved. There are approximately two hundred

more pages and many new illustrations and tables. New chapters have been added on listerellosis, Haverhill fever, tsutsugamushi disease, Q fever, jungle yellow fever, and lymphocytic choriomeningitis. Former chapters on louping ill and equine encephalitis have been combined with other similar diseases into one chapter on arthropod-bond encephalitides.

Diseases Transmitted From Animals To Man is an interesting and valuable book, which in its new edition should do much toward accomplishing the aim set forth in the opening paragraph of the author's preface, namely: "The diseases which animals may transmit to man remain of interest to the veterinarian and the physician, the research worker and the health official. Each is engaged with a different phase of the problem and views the subject from a different angle. The third edition, as was the first, is presented with each of them in mind, to afford a common meeting ground where each may understand the problems of the others and thus through concerted effort reduce the number of infections which man contracts from animals."

M. M. BROOKE

REHABILITATION THROUGH BETTER NUTRITION. *University of Cincinnati Studies in Nutrition at the Hillman Hospital, Birmingham, Alabama.*

By Tom D. Spies. W. B. Saunders Company, Philadelphia and London. $4.00. vi + 94 pp.; ill. 1947.

This interesting monograph summarizes certain experiences in nutritional studies conducted in Birmingham, Alabama. Because of the good response of a small group of patients to treatment, a nutrition clinic was established. Of 10,851 persons examined in the clinic, 5,140 did not have nutritive failure. Those with marked deficiencies were the indigent, those with histories of erroneous dietary habits or idiosyncrasies, people with diseases interfering with the ingestion or utilization of food, pregnant or lactating women or other persons whose physical activities had increased, and alcohol addicts.

More intensive study was devoted to 914 persons between 16 and 65 years old, who were incapacitated by their poor nutritional state, who were without means of changing their diet, and who had no serious organic disease and were not addicted to alcohol. Of this group, 452 had niacin deficiency, 355 riboflavin deficiency, 156 thiamin deficiency, 17 vitamin C deficiency, 61 had pernicious or nutritive macrocytic anemia, and 86 had iron deficiency. Under the prescribed regimes, 893 patients showed improvement and obtained work or went into the armed forces; 21 were unavailable for final check-ups, 9 by reason of death.

The symptoms of the various conditions are described, and corrective diets and representative case histories are included in the brief and readable text. The teaching of proper dietary habits is emphasized. There are diagnostic charts, colored pictures, considerable tabulated data, and several pages of bibliography. Typography, format, and paper are all of excellent quality.

HARRIETTE D. VERA

RH: *Its Relation to Congenital Hemolytic Disease and to Intragroup Transfusion Reactions. The General Practice Manuals.*

By Edith L. Potter. The Year Book Publishers, Chicago. $5.50. xvi + 344 pp.; ill. 1947.

The rapid growth of research dealing with "Rh" is vividly revealed by the citation at the end of this book of no less than 794 papers published on the subject since the discovery of the Rh antigen eight years ago. All workers in immunology and hematology, in gynecology and obstetrics, and in human genetics will remain deeply indebted to the courageous enterprise with which Edith L. Potter of the University of Chicago and the Chicago Lying-In Hospital has reduced the heterogeneous subject to an assimilable state. The puzzles of Rh-Hr nomenclature, of the blocking antibodies, of the variable clinical manifestations of hemolytic disease, and of alternative laboratory techniques have been skillfully clarified by the author. Even though she is guilty of fostering such genetic misconceptions as that, among the genes, there is "one gene concerned with the formation of each individual characteristic of the body—eye color, hair texture, and so on"; and that each fertilized egg possesses "hundreds of thousands of pairs of genes"—the author is nevertheless clear and consistent in her explanation of the genetics of Rh itself.

The author is perhaps weakest in her repeated insistence on certain personal views which still remain unsubstantiated, e.g., that abortion renders the isoimmunization of Rh-negative women more likely and that in general immunization occurs at labor and not during the course of pregnancy, as a result of red cells passing through the placenta. But this is a minor criticism of a very worthwhile book.

BENTLEY GLASS

HISTOPATHOLOGY OF THE EAR, NOSE AND THROAT.

By Andrew A. Eggston and Dorothy Wolff. The Williams & Wilkins Company, Baltimore. $18.00. viii + 1080 pp. + 30 plates; text ill. 1947.

This is in many respects a unique volume of pathology. Not only does it amply cover and profusely illustrate the gross and microscopic features of lesions occurring in the ear, nose, pharynx, and larynx, but it systematically and quite thoroughly reviews the comparative

anatomy, embryology, gross and microscopic anatomy, as well as the physiology of the same anatomical regions. Its comprehensiveness does not stop there, as it also includes a chapter on technic, that indicates how appropriate gross material can be obtained, and what the processes are to be followed in order that full-sized and well-stained sections, from the ear, in particular, may be secured for microscopic study. The beautiful reproductions of such sections of the petrous mastoid and mastoid process in health and in disease are an indication of the success and importance of such technical procedures. There is also a chapter devoted to the discussion of general pathology by way of introduction to those dealing with special pathology. The volume ends with a brief chapter on clinical pathology, in which the value of laboratory examinations in the field of otolaryngology is indicated, as well as the interpretation that is to be placed on these findings.

It is fortunate that the field of otolaryngology is sufficiently circumscribed as a medical specialty as to make it possible to cover within one volume all the important preclinical or basic scientific information relative to it.

The major faults found in the volume were the numerous misspelled words and the not infrequent poorly constructed phrases and sentences.

CECIL KRAKOWER

DISEASES OF THE NERVOUS SYSTEM *in Infancy, Childhood and Adolescence. Second Edition.*

By Frank R. Ford. Charles C. Thomas, Springfield, Illinois. $12.50. xviii + 1143 pp.; ill. 1945.

The first edition of this book was in 1937. The second edition was issued in March 1945, and a second printing was necessary in May 1946. This record is most convincing evidence that the book has met with approval and answers a need for an inclusive work on the neurological disorders of the early years of life. One must be impressed by the large amount of material treated in this single volume, which at the same time places due emphasis on subjects of practical importance. The first forty-nine pages describe methods of examining the nervous system, history-taking, the physical examination, and special examinations such as electromyography, spinal manometry, and electroencephalography. This last section is covered in less than three pages, and concludes with a helpful statement as to the usefulness of the method from a clinical standpoint, its uncertainty, its limited use in localization, and its use in the diagnosis of epilepsy.

A reasonably detailed section on the embryology, morphology, and physiology of the nervous system is included. This is treated with emphasis on its clinical aspects, with especial attention to the differences encountered in the pre- and post-natal periods and in the early years of life. Further consideration of the clinical aspects of the nervous system is similarly oriented.

The major portion of the book is devoted to the diseases, injuries, defects, and syndromes of the nervous system. A noteworthy feature is the organization and classification of each general section, such as the Prenatal Diseases, the Heredofamilial and Degenerative Diseases, and the Infectious and Parasitic Invasions of the Nervous System, to mention only a few. The classification of the infectious diseases is based first on their etiology and secondarily on the pathological anatomy, which fulfils the author's intention of permitting rapid orientation.

Treatment is dealt with in a candid way, often with the statement that no specific treatment is known, or that treatment is symptomatic. It might be useful if some mention were made of therapeutic methods, even those of little or no value, to prevent needless repetition of such therapeutic trials. However, this would no doubt require excessive expansion of the book.

In short, this is a book which is valuable both as textbook and for reference. It deserves a place on the shelf of anyone dealing with the diseases of infancy and childhood.

LOUIS F. CLEARY

IT'S AN ALLERGY.

By Frank G. Crandall, Jr. Murray & Gee, Hollywood. $3.00. 318 pp. 1946.

This book has been written for the purpose of explaining allergy "so that the public can understand more fully this important field of medicine." The author makes this statement in the preface. In order that any such education might be satisfactory, an author should be most discriminating in his selection of the data to be presented to the lay reader. Controversial phases of the subject should be omitted from such a publication, for their discussion produces confusion rather than understanding. Furthermore, the imagination of a susceptible reader can stretch to such a degree that his reward for reading this book may well be a pseudo-allergy.

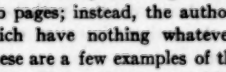
The author has written a three-hundred-and-five page book, consisting of fifteen chapters. The first four of these are respectively devoted to the definition, frequency, diagnosis, and treatment of allergy. In the next ten chapters, various allergic manifestations are discussed. In the final chapter, the author gives the patient specific instruction in the management of allergic diseases.

To illustrate the manner in which allergens afflict a patient, many interesting case reports are presented in appropriate context. Undoubtedly these experiences encountered by the author will be of great interest to any reader, but of paramount interest to that partic-

ular reader who sees in some case report a possible explanation of his own allergic condition.

The author is an advocate of testing his "patients with extracts of several hundred different allergens." He states that "until the advent of allergy, medicine offered no adequate explanation of stomach ulcers," and then he renders the opinion that "in practically every instance, ulcers are either caused or aggravated by food allergy." The chapter relating to allergy of the nervous system might have been condensed into two pages; instead, the author has discussed entities which have nothing whatever to do with allergy. These are a few examples of the errors of commission which are to be encountered in this publication. The reviewer's conservative judgment is that the publication will be more likely to confuse the lay reader than to give him a clear understanding of allergic diseases.

LESLIE N. GAY



MONGOLISM AND CRETINISM: *A Study of the Clinica Manifestations and the General Pathology of Pituitary and Thyroid Deficiency.*

By Clemens E. Benda. Grune & Stratton, New York. $6.50. xvi + 310 pp.; ill. 1946.

Mongols and cretins have been confused with each other, as the author points out, for ages. As to the mongols, a fertile modern source of confusion has been the name itself. It is therefore surprising to read that the classic description of this type by Seguin in 1866 rightly recognised its most obvious facial characteristic as being due to a curtailment of the skin at the margin of the lid. Unfortunately, the ethnic predilections of Langdon Down, writing in this same year, prevailed, and finding a congenial acceptance in nineteenth century assumptions, remained to becloud the etiology of this condition. The dilemma of the Chinese physician who finds the disease in his own population is apparent. From the compelling arguments of the author, mongolism is congenital acromicria, or pituitary hypoplasia, and the bony development found is the obverse of that in acromegaly. The large series of cases (300) studied, some over a ten year period, makes much of the work reported definitive in this field. Because of the large amount of comparative data he has been able to supply, the author seems justified in adding his observations on cretinism, or congenital thyroid aplasia, to this volume.

Many fields are considered in relation to these conditions; one would hesitate to agree, in regard to endocrine treatment, that "we need pituitary extracts from immature animals" for the treatment of children. In view of the large amount of case history and tabular material presented, one would like to have found a final chapter summing up the entire field, along the lines of the synopses scattered through the book.

H. R. CATCHPOLE

GYNAECOLOGICAL ENDOCRINOLOGY *For the Practitione. By P. M. F. Bishop. A William Wood Book, The Williams & Wilkins Company, Baltimore.* $2.00. viii + 124 pp. + 1 chart. 1946.

The reviewer has an ingrained aversion to synopses and compendia, and so when he opened *Gynecological Endocrinology* he did it begrudgingly. However, after reading the first several pages he changed his attitude, for here is a succinct, accomplished statement of the practical aspects of the hormones in relation to gynecology.

The endocrine control of the menstrual cycle is first summarized. The several sex hormones and their modes of administration are discussed. With these fundamentals established Bishop then diagnoses and treats the various aberrations of menstruation: amenorrhoea, hypomenorrhea, hypermenorrhoea, oligomenorrhoea and polymenorrhoea. Painful menstruation, the menopause, infertility, and pregnancy are each similarly analyzed in separate chapters. The book is concluded with a description of the three biological pregnancy tests and a confession of how laborious, inexact, and impractical are the modern methods of hormone assay. An appendix of 20 pages lists the commercial hormones available in December, 1945, their manfacturers, modes of administration, doses, and prices in British coinage.

The author is intensely practical, frank, and conservative. He obviously knows the literature but does not clutter his very brief treatise with a review of pertinent articles. The book is well adapted to the intelligent general practitioner and the open-minded gynecologist as well.

The reviewer wishes that the type had been reset for the American printing, for the constant use of such words as "shewn" is distracting, and also the prices of drugs in England are of little guidance to the American practitioner. The reviewer further considers the thyroid a gland with important gynecological effects and thinks that its exclusion in such a brochure is an oversight. The treatment of habitual abortion is too didactic, the author only mentioning progesterone in its treatment and not even hinting that such therapy may have little value and that many believe thyroid and stilbestrol are far superior. Several minor faults could be listed, but all in all Bishop does a most competent and orderly job in a very few pages.

ALAN F. GUTTMACHER

EXPECTANT MOTHERHOOD. *Second Edition, Revised. By Nicholas J. Eastman. Little, Brown and Company, Boston.* $1.50. xiv + 198 pp. + 2 plates; text ill. 1947.

Advice books about pregnancy antedate the printed page, and if all placed side by side a large library would result. Among the most widely read of the modern

era is Eastman's *Expectant Motherhood*, first printed in 1940. During the succeeding seven years it was reprinted fifteen times and currently appears completely revised.

Expectant Motherhood is written for the intelligent layman. The author captivates the reader by his authoritative, sincere, simple style; a style devoid of window-dressing. A great amount of valuable, practical information is packed into the small volume. If one were to offer any general criticism, he might take the author to task for the almost complete absence of historical data, a field in which the author himself has frequently demonstrated his special competence. The only excursion into medical history which he has allowed himself is a few paragraphs concerning the origin of the obstetrical forceps. The reviewer feels that medical books written for the layman should not only present the essential facts, but the historical evolution of their acquisition. Such a combination educates the public in an appreciation of modern scientific medicine, plus a better understanding of its peripheral quackery.

Several new chapters have been added to the first edition. One of these is an excellent chapter on weight control in pregnancy, with sample menus. "How to telephone your doctor" is an intriguing inclusion, its purpose—to make telephone consultations more efficient and satisfactory. Paragraphs on the much discussed Rh factor and on controversial caudal anaesthesia first appear in the revised edition.

In one instance Eastman allows faith in democracy to outweigh scientific critique. Because 84 per cent of seventy-five obstetrical authorities assume that smoking and inhaling twenty-five or more cigarettes daily have an unfavorable effect on the health of the pregnant woman, he too implies that this is the case. Yet neither he nor the other authorities offer scientific data to support this prejudice.

All in all, *Expectant Motherhood* does an excellent job. Eastman makes a painstaking attempt to replace the subtle fears and folk misinformation of the pregnant woman and her near kin, by calm assurance and scientific knowledge. And he succeeds.

ALAN F. GUTTMACHER

THE PROBLEM OF FERTILITY. *Proceedings of the Conference on Fertility held under the auspices of The National Committee on Maternal Health.*

Edited by Earl T. Engle. Princeton University Press, Princeton. $3.75. x + 254 pp. + 6 plates. 1946.

This volume is a continuation, along similar lines, of the series of proceedings of the annual conference on fertility, sponsored by the National Committee on Maternal Health, and under the editorship of Earl T. Engle. Previous proceedings have been published in various ways but none as elaborately as this one. As in the previous proceedings, the papers cover a number of fields but have a common focus. Unfortunately, the title does not suggest the real breadth of view nor the wide background that the book reflects. Actually much of it is a very important excursion into the field of reproduction in the domestic animals, a field in which the workers are fully aware of the work done clinically and on the laboratory animals, but which is almost unknown and practically ignored by most workers not directly concerned with agriculture. The editor is to be congratulated for bringing the two fields together and in producing the volume.

Of sixteen papers, the first six deal with a wide variety of mammals. This section is useful in introducing the reader to the work done on the domestic animals, ranging through patterns of estrous cycles, histological studies of the maturing ovarian follicle, the induction of ovulation, the hormonal control of ovulation, and a review of the work on ovulation and estrus in sheep and goats. The two papers following report on a much more restrictive field of study: the cervical mucus of the human female. The second of these, on spermatozoa and cervical mucus, leads rather naturally to the next section. Its five papers give extensive accounts of research on the spermatozoa of human, rabbit, bull, and horse. In some respects this section is the most homogeneous section of the book.

Three papers do not fit into the three sections mentioned above. The final paper in the volume is a discussion of methods used in the determination of the time of ovulation in the larger domestic animals. The effects of thyroprotein on the reproductive capacity of bulls is discussed in another paper; and a third paper discusses the cervix uteri in sterile matings. In this paper two statements deserve comment: one wonders why J. Marion Sims is "Marion Sims of Paris"; and again, what comment Reginald the office boy (of hallowed memory) might make on the author's device of calling artificial insemination "semi-adoption."

ROBERT K. ENDERS

THE VENEREAL DISEASES: *Manual for Practitioners and Students.*

By James Marshall. Macmillan & Company, London. $4.50. xii + 348 pp. +8 plates; text ill. 1944.

Most of the text is devoted to a detailed description of the numerous manifestations of gonorrhea and syphilis. Other venereal diseases and lesions and conditions encountered in venereology are discussed more briefly. The fact that "diagnosis precedes treatment" is emphasized, and a plea is made for careful and thorough examination of patients. Instructions for treatment of gonorrhea with sulfonamides and of syphilis with bismuth and arsenicals and other practical techniques are included.

The manual was, unfortunately, written before

penicillin became readily available and relatively inexpensive, so other sources must be consulted for newer methods of therapy.

Illustration is by means of a few diagrams and numerous photographs, a number of which are reproduced in color. A very short bibliography and an index complete the book.

HARRIETTE D. VERA

EXPERIMENTS ON THE PRESENCE OF CARCINOGENIC SUBSTANCES IN HUMAN SURROUNDINGS.

By Theodore van Schelven. Kosmos Publishing Company, Amsterdam, Holland. $1.00 (paper). 16 pp. 1946.

This is a mere pamphlet or reprint stating the author's views on the cause of cancer. The views expressed are supported by data from experiments that appear to be thorough and well done. It is stated that the partial carbonization which takes place when foods are subjected to certain ordinary kitchen procedures is accompanied by the production and appearance of carcinogenic materials with black crusts. The author suggests that "a slight correction of our basic kitchen techniques seems to be advisable: boiling and stewing, even with the formation of brown crusts being apparently inoffensive, the avoidance of the formation of black crusts in the processes of roasting, frying and baking might be desirable."

The basic facts presented in the paper are not new, in spite of the attempt to create such an impression. Numerous other investigators have shown that heating diverse substances and materials to produce tars and crusts gives rise to carcinogenic substances. The only point of difference in technique, as compared with those used by other investigators, appears to be the limitation of the heating to "ordinary kitchen techniques." It is more than regrettable that there is no bibliography.

FRANK H. J. FIGGE

MUSIC IN MEDICINE.

By Sidney Licht. New England Conservatory of Music, Boston. $3.00. xx + 132 pp. 1946.

This short book is a simple, general survey of musical therapy, written, as the author states, "with a view to preserving for medicine that which is good for patients, in an attempt to aid musicians under medical guidance in using music to help the sick."

Some chapter headings will convey the form and emphasis of the text. For example, Licht begins with The History of Music in Medicine, including references to music in primitive and ancient civilizations up to recent times, including literature from various periods. The following chapter, on the Philosophy and Psychology of Music, emphasizes in general the moods and emotional reactions that may be suggested by various instruments and musical scores. Following this come Music as Occupational Therapy, Psychiatry and Music, and subsequent chapters that deal with the use of music in the background, at mealtimes, and for diversion. Some mention is also made of programming equipment and lastly of the medical direction. Training for such work, Licht believes, should be carried out by cooperation between musician and doctor.

Some may feel that this work belongs to those of special interest and training in the department of Occupational Therapy. Fortunately, Licht has kept in mind the need for critical analysis of the scope and possibilities of music as a therapeutic agent rather than the mere tool of a "healing cult."

At present, it is difficult to see how music may be fitted into an acutely crowded hospital program so as to give more than the usual lift of entertainment appropriately applied. On the other hand, it is to be hoped that through further interest and research the possibilities it may offer in the more chronic states of illness will be explored and the doctor given more specific aid in his work.

LUCILLE CARTER

HEALTH INSURANCE IN THE UNITED STATES. *Studies of The New York Academy of Medicine Committee on Medicine and the Changing Order.*

By Nathan Sinai, Odin W. Anderson, and Melvin L. Dollar. The Commonwealth Fund, New York. $1.50. xvi + 115 pp. 1946.

Much factual material has here been condensed into a short but significant publication dealing with the history, development, and trends of group health prepayment plans. The text centers around voluntary hospitalization plans, as exemplified by the Blue Cross and the medical service plans sponsored by medical societies (e. g., that of Michigan), since these two types have the largest enrollments and are the most active and important at the present time. Attitudes which have been held by professional, lay, and government groups toward such plans are summarized. Enabling legislation is also discussed, the characteristic features and inadequacies of voluntary plans are surveyed, and the problems that confront the extension of their services are analyzed.

This valuable monograph is another of the series prepared under the auspices of the Committee on Medicine and the Changing Order, of the New York Academy of Medicine. It is recommended for reading by every one who possesses any social consciousness. Because the American scene is a changing one, and because the health insurance movement is advancing rapidly, it is to be hoped that revisions of this book will be published frequently.

HARRIETTE D. VERA

PSYCHOLOGY AND ANIMAL BEHAVIOR

ENCYCLOPEDIA OF PSYCHOLOGY.

Edited by Philip Lawrence Harriman. Philosophical Library, New York. $10.00. viii + 897 pp. 1946.

There are so many things wrong with this book that it is laborious to list them. Most of them pertain to the discrepancy between what an encyclopedia ought to be and what this book actually is. What it ought to be, I suppose, is a well-classified directory of knowledge. In fact, it is a poorly organized assortment of items which range from elaborated dictionary definitions to long treatises. Its chief weakness is lack of balance, organization, and sound allotment of space to various topics; in short, a weakness of editorship. Although the reviewer must not be presumed to have read every article in the book, he has found little to criticize in the content of those that he did read. True, some are mediocre, but many are first class. As a group, the individual contributors are not to be blamed for the deficiencies of the book. This brings us back to the responsible person, the editor.

The index is less than 3 pages long, which is insufficient, for it is mainly an index of titles and not of topics. This makes it hard for the reader to find anything on "Drive," for example, because there are no articles with titles beginning with D. No mention of Instinct in the index either, though of course P. T. Young's chapter on Motivation discusses both. As to space allotment, Primary Abilities is discussed by Thurstone in 1½ pages, whereas it takes Barr more than 15 pages for Personnel, Teacher—and Porteus nearly 7 pages for Porteus Maze Tests. This is shockingly disproportionate, but at least these topics are, legitimately enough, dignified by treatment as special articles, which is more than the editor allowed Audition, Vision, Kinesthesis, Imagination, Feeling, Judgment, Reasoning, Memory, Statistics, or History of Psychology, just to take a sample of common textbook topics which come to mind. Of course these topics are not *totally* ignored. One can run down parts of several of them, hiding under other titles. How many readers are going to want to hunt out these topics without the aid of a topical index? One last evidence of peculiar selective emphasis: The *only* person mentioned in the entire index, and allowed a special article, is C. G. Jung!

No doubt a statistical count of omissions and errors would portray the book's deficiencies more accurately than these selected examples, but the book is hardly worth such close examination. It certainly is not a good encyclopedia. I cannot recommend it as such to the "serious investigators" or to the "undergraduate and graduate students" mentioned by the editor as possible readers. Furthermore, it would give a seriously distorted picture of psychology to non-psychological scholars.

S. B. WILLIAMS

ADJUSTMENT TO PHYSICAL HANDICAP AND ILLNESS: A SURVEY OF THE SOCIAL PSYCHOLOGY OF PHYSIQUE AND DISABILITY. *Social Science Research Council Bulletin 55, 1946.*

By Roger G. Barker, Beatrice A. Wright, and Mollie R. Gonick. Social Science Research Council, New York. $2.00 (paper). xii + 372 pp. 1946.

This is an admirable and interesting presentation of objective data and corresponding impressions which deal with the relations between physique and behavior. The authors use the term physique to denote "any structural or functional aspect of the physical organism except the central nervous system." These relationships are referred to as "somatopsychological."

Among the sections of the survey are those devoted to crippling, tuberculosis, and impaired hearing. Especially interesting was the portion of the chapter on Normal Variations in Physique that deals with "overlapping situations and adolescence." Illustrations stress the problems of the adolescent which occur when the rapid change in physique associated with maturation make possible or require of him adult activities for the first time. The objective questions raised regarding the source of behavior in the various individual types are uncolored by the prejudices often encountered in those of a more medical bias and are thereby stimulating. This is especially true of the section on the tubercular person. The lack of medical bias, on the other hand, may also account for the fallacious opinion of the authors that they can study or have studied factors that are unrelated to the central nervous system. A somewhat conspicuous shortcoming of the study appears in the paucity of observations relating to early dynamic family relationships and their contributions toward the form and degree of individual reaction to variations of physique, crippling, or other disabilities, etc.

PAUL GRAY

THE RELATION OF PARENTAL AUTHORITY TO CHILDREN'S BEHAVIOR AND ATTITUDES. *The Institute of Child Welfare, University of Minnesota, Monograph Series, Number XXII.*

By Marian J. Radke. The University of Minnesota Press, Minneapolis. $2.00. x + 123 pp. + 1 plate; ill. 1946.

PATTERNS OF PARENT BEHAVIOR. *Psychological Monographs, Volume 58, Number 3, Whole Number 268. By Alfred L. Baldwin, Joan Kalhorn, and Fay Huffman Breese. The American Psychological Association, Northwestern University, Evanston, Illinois.* $1.50 (paper). iv + 75 pp. 1945.

These two monographs represent efforts to assess, through the research psychologist, what goes on between children and their parents. Neither paper, of course, purports to cover the whole field of this

complicated relationship. The respective authors are fully aware of nuances and undercurrents which even the most ingenious statistical method cannot reach. However, by an intelligent limitation of their research goal, each has provided a significant contribution to the better understanding of parental attitudes and their ultimate effects.

The authors approach the issue from entirely different angles. Marian Radke describes her project as a study of the "nature of parental authority and discipline relations and their correlates in the behavior and attitudes of pre-school children." To do this she took as subjects 43 pre-school children from upper middle-class urban society. Through parental questionnaires, teachers' ratings, two individual but systematized interviews with each subject and an oral questionnaire given to each child, she obtained considerable data upon which to evaluate the home relationships and the childrens' behavior in response to them.

The investigator found, in this survey of her rather special group, that in this generation there has been a decrease in the emotionality of parent-child discipline situations, a decrease in autocratic methods of control, and an improved parent-child rapport. The pre-school children she interviewed were surprisingly cooperative and informative. From assessing the childrens' point of view, Radke observed that many adult-inflicted disciplines are completely misunderstood by the pre-school child, who reacts with fear of the parent rather than with a realization of why punishment has been meted out. The result is an undermining of the child's sense of confidence and security rather than a valid gain in social control. The author feels that this area merits more investigation, in order to see if disciplinary measures cannot be geared more satisfactorily to the child.

Baldwin, Kalhorn, and Breese, on the other hand, have developed their study from the material of a much larger research program being conducted by the Fels Research Institute. This Institute was set up to make detailed chronological studies of children from before birth to maturity. 125 cases, thoroughly evaluated by statistical and clinical methods, were utilized by this group. They postulate their aim as being "to discover attitudes which underlie some common patterns of parent behavior, to relate these attitudes to other aspects of the home, and. . . to show the relationship between these parental attitudes and the developing personality of the child."

These investigators, making careful use of their highly impressive assemblage of data, break down parent behavior into three fundamental syndromes, with plus or minus ratings—democratic (as opposed to autocratic), indulgent (as opposed to casual), and acceptant (as opposed to rejectant). The parent group was then subdivided into seven secondary syndromes, each with a characteristic picture. It was found that these syndromes could be correlated positively with the intelligence of the parents. It was also established that these basic patterns observed by the authors were related to meaningful and explicable trends in the children. It became apparent that the children from a home environment classified as "democratic-acceptant" were the most comfortable and confident youngsters.

In both these monographs the authors have established the need for further research in the evaluation of parental attitudes. In no way do the two papers overlap, either in material or in procedure. However, despite their separateness one feels that each study has hit on the same basic principle of child-parent relationship, namely, that children do understand and respond more happily to a warm, mature, and democratic family atmosphere than to any other. The question next becomes how to use this principle in educating adults for more effective parenthood. Further studies will, no doubt, elucidate the factors which hinder or implement the principle. It is to be hoped that these investigators will all continue their contributions in this area.

HELEN HEWITT ARTHUR

UTILIZING HUMAN TALENT: *Armed Services Selection and Classification Procedures.*

By Frederick B. Davis for the Commission on Implications of Armed Services Educational Programs. American Council on Education, Washington, D. C. $1.25 (paper). x + 85 pp. + 1 plate; text ill. 1947.

The series of which this pamphlet is a part is intended to examine the educational programs of the armed services and to seek implications for civilian education. This particular contribution is concerned with the implications to be derived from the procedures used in the selection and classification of service personnel. The author has clearly made an effort to offer something to each of several very different groups. For the relatively uninitiated there is a brief factual description of the selection and classification procedures employed by the various services. For those who want practical suggestions with a minimum of worry about theoretical background, there is a presentation of ten neat implications. For the more technical-minded, there is an appendix devoted to more technical problems.

Although comprising only 31 of the 85 pages, the section dealing directly with the implications is undoubtedly the meat of the contribution. The first section merely provides general orientation, and the appendix is truly an appendix. The hurried reader, by the way, could safely omit the first section with its general description. There is very little specific reference to it, or use made of it, in the development of the argument regarding the implications.

We are warned that only sparse and trite implications

for civilian education should be expected from the program of the services. The service programs, after all, relied chiefly on techniques and procedures derived from civilian education in the first place. For some of the implications the warning is well given. We are told, for instance, that many more apt students in various fields could be discovered, and guided more efficiently than at present into suitable training, by a use of better (and longer) aptitude tests, and that the progress of these students might be better evaluated through tests having norms drawn from widespread regions. Rising one cut above these rather platitudinous implications, we find some important, if not startling, suggestions. There is no royal road to aptitude testing. Although a test of fundamental scholastic aptitude is useful, it is not nearly enough. There is usually some specific test which excels the general test as an indication of a special aptitude. These specific tests, to be of maximum use, must be more complex than we may like to think. They must be longer than those now in use, and must give separate measures for a larger number of factors than we are accustomed to deal with. There are other important emphases regarding the influence of a restricted range of talent, and the importance of realistic validity in a criterion test, even at the cost of reliability. We are also cautioned not to expect the insight of the clinician to add appreciably to the predictive value of test results.

There is little attempt at a rigorous justification of any of the implications. Perhaps that would have been out of place. But the problem might have been raised, and an appendix might have given some hints, at least, as to how we might go about demonstrating some of the assertions made. What evidence is available, for instance, to demonstrate that "*Effective* (italics added) educational and vocational guidance can be provided. . . ."? Even if clear demonstrations are not possible, we might be told whether a particular implication is based on the fact that the services merely used a given technique, or that some officers liked it, or that there is objective evidence of its effectiveness.

One might have expected a richer harvest of implications and on a grander scale. The unique thing about the Armed Services, after all, was not their use of novel techniques of selection, but the sheer size of the enterprises. We remember the enormous number of cases, the appalling degree of control, the vast resources in money and in technical skill. There was also an unparalleled opportunity for boldness, as when a large number of apparent misfits was sent through a training program merely to test the validity of the selective procedures. What are the implications from these features of the program? Can the civilian agencies expect satisfactory results with fewer cases and with less direct control? Must we be prepared to multiply our technical staff to parallel the technical services used by the services? Along with a scarcity of implications of this nature, one notes relatively little distinct discussion of techniques for "selecting" emotional misfits or other persons in need of therapy.

It is probable that a book which would have escaped these strictures, would, by that very fact, have failed to accomplish the purpose of those who originated the series. This contribution to the series probably does what it was supposed to do. It provides a clear unworrisome discussion of a minimum list of implications which, even when trite, can bear restatement.

J. M. STEPHENS

THE PSYCHOLOGY OF EVERYDAY LIVING. *By Ernest Dichter. Barnes & Noble, New York.* $2.50. xii + 239 pp.; ill. 1947.

Most of this book consists of short sketches already published in the *Journal of Living*, in *Look Magazine* (Psycho Quiz), *Coronet*, or other magazines. The sketches or talks are extremely short, rarely exceeding five pages. They cover a variety of subjects, most of them being oriented to the little things of life.

The first general division deals with attitudes and emotions. It consists of fifteen sketches on such topics as running away, meeting challenges, tolerance frustration, and the like. Other divisions are: Getting Fun Out of Life, Winning Social Prestige, Health and Efficiency, and A Task for the Social Engineer.

In the first divison there is some coherence. The coverage, of course, is by no means complete. The method of making the book precludes an adequate system of selecting the topics falling under any division. Even making allowances for this fact, however, it is disturbing to learn, by implication, that fun in life stems exclusively from automobiles, cigarettes, and radios. No wonder our ancestors were a glum lot! It may also be surprising to find so overwhelming a role played by soap, cosmetics, apparel, and liquor in the problem of winning social prestige.

In most sections there is an understandable avoidance of long or complicated sentences. Photographs are used very freely but not always with much point.

J. M. STEPHENS

PSYCHOLOGY IN LIVING. *New Revised Edition. By Wendell White. The Macmillan Company, New York.* $2.95. xx + 393 pp. 1947.

Psychology in Living will probably interest readers of this journal chiefly as a book to recommend to friends who want helpful advice. There are two parts. The first, dealing with personal relations, is the most unusual. It presents an intensive analysis of the problem of influencing people while still keeping them as friends. This treatment is unusually rich in practical illustrations, whole pages being given to the actual words

which might be used to accomplish various purposes. The advice which accompanies this analysis is difficult to evaluate. There is, of course, no pretense of experimental verification. As far as sheer general impression is of interest, the suggestions seem shrewd, plausible, provocative, and convincing. The reviewer found himself commenting, "Sounds like a good idea" or "Must try that sometime."

The topic of love would appear to have an unchallengeable claim to a position under the heading of personal relations, and White so includes it. In spite of the logical propriety, however, the tone of this section is so different from that of the personal relations earlier discussed that one feels an abrupt transition from directors' meeting to trysting place. This section, although marked by its dependence on common sense, makes considerable use of classical psychological data.

Part Two, treating the field of mental hygiene, uses traditional psychological concepts. This section seems no better and no worse than many other current treatments. Perhaps there is more emphasis than usual on such moral or ethical problems as jealousy or envy. This is in line with the general centering of interest on problems to be solved rather than on the evidence available for their solution.

This is clearly a book for the practical man who wants specific suggestions for improving his salesmanship, his persuasiveness, and his social effectiveness. It is a compendium of advice presented in a practical, lucid and forceful manner. In the opinion of this reviewer, it is one of the better books of its kind.

J. M. STEPHENS

PERSONALITY: *A Biosocial Approach to Origins and Structure.*

By Gardner Murphy. Harper & Brothers, New York and London. $5.00. xiv + 999 pp. 1947.

Few modern scientists dare attempt to describe the "whole personality." It is perhaps the "64-dollar question" of modern psychology. The question is so enormous and our data so meager that most writers prefer either to leave it alone, or, to judge by current titles, to tackle it bit by bit. It is much easier to test one Freudian hypothesis by an ingenious experiment or to review the inconsistencies in a colleague's thinking than it is to develop one's own complete and systematic description. It is therefore an occasion for applause when we see a man brave enough to take on the big question.

Gardner Murphy is chairman of the Department of Psychology at City College, New York. He has already won a reputation as an outstanding "library scholar," that is, a person whose talent lies in the evaluating of other people's researches. The book reflects a voluminous amount of reading on Murphy's part and a considerable digestion of what he has read. He does not pretend to offer a new theory, but, by way of evaluating most of the modern theoretical ideas, he does perhaps give the reader a new orientation. By a kind of dialectic, Murphy concludes that no present theory, or methodology for that matter, is *sufficiently* satisfactory for a complete description of the human personality, though each is minimally satisfactory for small segments of the entire task.

The book is, more than anything, a modern and sophisticated essay, or series of such essays, intended for readers who are already familiar, at least in a general way, with the experimental and clinical literature. It is rather too long (one short of a thousand pages) and too discursive, which tends to make it dull reading. Further, Murphy appears too eager to synthesize and to integrate and is not always penetrating enough in his critical analysis. This gets him sometimes into the silly position of integrating other people's ideas if they come from "respectable" experimental or clinical sources, whether they represent real, tested facts or not.

These are relatively minor criticisms. In spite of emphases not always to the reviewer's liking, the book does contain a great deal of stimulation for the serious student. It is, in a sense, genuinely comprehensive. It is relatively free of dogmatism, which cannot be said of some other books in the same field.

STANLEY B. WILLIAMS

DESCRIPTION AND MEASUREMENT OF PERSONALITY. *Measurement and Adjustment Series.*

By Raymond B. Cattell. World Book Company, Yonkers-on-Hudson, New York. $4.00. xx + 602 pp. 1946.

Psychology as a profession has undergone significant changes in the last few years. The impact of the war produced a need for psychologists to predict the behavior of large numbers of people in a variety of real-life situations. This need was both genuine and immediate. Many psychologists left their laboratories in response to it, and the field now teems with clinical, consulting, personnel, vocational, and applied psychologists.

But there is cause for serious concern in this turn of affairs. Too much recent research is devoted to the practical, superficial prediction of behavior of specific kinds; too little to the integrative study of the dimensions of human abilities and personalities. Too often is there a slavish devotion to published psychological tests because "they seem to work"; too seldom is there any critical inquiry into precisely what these tests measure. Though a clinical psychologist himself, Cattell is a severe critic of the empirical "ad hoc research finding, permitting no generalization to other situations and requiring to be re-proved in each of a

thousand situations." For this reason alone, his book is a welcome and refreshing addition to this field.

This is the first of two books attempting to bring into perspective the knowledge we have regarding personality, and to suggest problems and methods for further organized research. The present volume is mainly concerned with cross-sectional studies; the second volume, to be published later, will stress the developmental approach.

The first part of the book is a methodological introduction which amplifies in great detail the use of factor analysis for discovering and isolating personality traits. This is heavy reading—it demands familiarity with correlational procedures, advanced general statistics, and the basic devices of factor analysis. But the methods treated here are well worth careful study, for, in the reviewer's opinion, they represent about the only way of achieving any coherence and system in the description of personality.

The second part of the book will probably interest more readers. In it, the author has attempted to review all earlier work on the description of personality. Studies are grouped into four categories depending on the source of the data: clinical observation, behavior rating, questionnaire, and objective test measurement. In each case, the author tabulates and compares the principal traits isolated. The final chapter lists 12 source traits which consistently emerge in the great majority of the studies, irrespective of the kind of data used. These 12 traits occur so often that they may be considered as established primary traits of personality. Each of these primary traits is described in detail.

All in all, this book is an important contribution to the field of personality measurement. It is a fairly difficult book, highly theoretical, and suitable as a text only for advanced courses and seminars in personality. The clinician and practical psychologist will probably be disappointed in it, for, despite its title, there is virtually no discussion of specific tests or measurement devices for assessing personality. Even so, its systematic contribution is so great that it must certainly be classified as required reading for psychologists in this field.

A. CHAPANIS

INSIGHT AND PERSONALITY ADJUSTMENT: *A Study of the Psychological Effects of War.*

By Therese Benedek. The Ronald Press Company, New York. $4.00. xii + 307 pp. 1946.

This is a well organized, readable book about the psychological effects of war, as it has impinged not only on the soldier but also on his parents, his siblings, his wife, and his children. It is designed particularly as an orientation study for social workers, clergymen, teachers, and others who are dealing in guidance roles with people who have been affected and modified by the mass upheaval of the recent conflict.

Therese Benedek has divided her book into four parts. A short but practical opening section of 40 pages is entitled: The Individual. In it the author deftly outlines the psychodynamics of individual development as a background for her more specific thesis.

Part Two, The Soldier, is a comprehensive study of how the civilian male makes an adjustment to becoming a soldier, of how Army life influences him, and of his problems of readjustment on returning to a civilian status. The author develops her theme on the basis of the unconscious motivations and reactions which take place, and she does this in a direct, matter-of-fact style that is understandable and convincing.

In a similar forthright fashion, she takes up Part Three, The Family in War, and elucidates the complicated emotional situation between mothers and soldier-sons. She also describes the relationship between fathers and soldier-sons, the reactions of soldiers' siblings, the unconscious issues between soldiers and their wives—both during separation and on being reunited—, the psychological process of mourning, the disabled soldier, and the complex emotions involving soldier-fathers and their children.

Part IV, Men, Women: The Changing Sexual Mores, is utilized by Benedek to go more fully into the impact of the war on social groups other than the soldiers themselves, i.e., on the adolescents and women. In attempting to make intelligible our social structure of today, the author emphasizes the importance of a general shift in what were once rather clearly defined emotional supporting roles. Without an appreciation of how the wartime adolescent has been precipitated into adulthood and how women have assumed a new (if uneasy) status, both emotional and economical, no guidance worker can hope to make a genuine contribution toward another individual's adjustment within this changing social scheme.

Altogether Benedek has written a very worthwhile book. It is a lucid, undramatized account of what has happened, emotionally, to people since war was declared. It should be read not only by professional counselors and psychologists but by all to whom so cogent a summary of the effects of war on our society might be a useful and thought-provoking message, giving a better understanding of the personal struggle our adult and teen-age population is now engaged in.

HELEN HEWITT ARTHUR

MILITARY NEUROPSYCHIATRY. *Research Publications, Association for Research in Nervous and Mental Disease, Volume XXV. Proceedings of the Association, December 15 and 16, 1944, New York.*

Edited by Franklin G. Ebaugh, Harry C. Solomon,

and Thomas E. Bamford, Jr. The Williams & Wilkins Company, Baltimore. $6.00. xviii + 366 pp.; text ill. 1946.

This interesting volume comes at a rather late date, some two years after the war. However, it still sheds light upon the attack on psychiatric and neurological problems that faced the Medical Corps of the Army and the Navy during the past war. The Proceedings include thirty-three papers by such contributors as Whitehorn, Grinker, and Rome—to name only a few.

Most of the material presented at the meeting dealt with the neuropsychiatric difficulties that were becoming more and more apparent as the war progressed, and even late in 1944, one and one-half years before the war ended. Thinking aloud seems to have occupied a good deal of the time of the contributors, as various ones among them made great efforts to compare the psychiatric problems that were seen during World War I with those met currently. Whitehorn offered a triangulation theory concerning the diagnostic nomenclature for psychiatric casualties. Other contributors dealt with malingering, war neurosis in fliers, emotional problems of demobilization, psychiatric reaction to amputation, combat exhaustion, and other pertinent topics, all of prime importance and representing some of the most pressing problems facing the military medical authorities. The association leaders seem to have been concerned with stressing the fact that the armed forces were applying such definitions as "combat fatigue" to real neuropyschiatric problems, and were perturbed by the fact that there had been a certain schism in the liaison between the non-medical branches of the armed forces and the medical branches. For example, there was always a certain amount of hesitancy to say that a soldier or a sailor was suffering from a mental disorder, and it seemed that the effort not to hurt the feelings of the line officers primarily, and the patient secondarily, often limited the military psychiatrist's job to that of a diplomat who had to salve the feelings of those who were irked by the truth.

Included in the papers are several excellent neuropathological projects. The paper by George M. Hass on cranio-cerebral injuries of personnel involved in aircraft accidents is most illuminating and instructive. The electroencephalograph contribution is more than adequately handled by Ephraim Roseman and Barnes Woodhall, who write on that most interesting and perplexing problem, the incidence of post-traumatic epilepsy. Lawrence Kubie and S. Margolin contribute one of the better controlled research projects: on the therapeutic role of drugs in the processes of repression, dissociation, and syntheses. Grinker's sodium pentothal abreaction treatment is adequately discussed.

In concluding, it can be said that this compilation represents the efforts of the leaders in the fields of neuropsychiatry to synthesize and put into action the combined knowledge of military and civilian scientists so that there will be a certain amount of liaison in the handling of neuropsychiatric casualties and further that the beneficiaries of scientific thought, the men on the fighting fronts, will profit thereby and be better soldiers in a war and better citizens on the return from war.

ROBERT MAZER

PSYCHIATRY FOR SOCIAL WORKERS.

By Lawson G. Lowrey. Columbia University Press, New York. $3.50. xii + 337 pp. 1946.

This book is well-named. It gives in a single volume a discussion of mental disorders in a fashion which is both understandable and usable for social workers. It is evident that Lowrey has a fine conception of the problems which the social worker must meet in her everyday job. He has succeeded in presenting his discussion of mental illness in such a way that the social worker can profit by it in her contacts with clients and their problems.

It is made clear by the author that he is not attempting to have his book serve as a textbook on psychiatric disorders but rather to give social workers some understanding of what to look for in the behavior of persons which will mark them as needing psychiatric help. He has clearly distinguished the types of situations in which the social worker can safely work alone with a client from the situations in which she needs to seek the aid of a psychiatrist for the client. The social worker is warned against attempting to give treatment for which she has not been trained. At the same time it is recognized that the social worker can be of great value in the treatment of patients when she knows her function and limitations. Of particular value to those social workers concerned with children's problems are the chapters on behavior disorders. Clear statements are made regarding the most common behavior problems found in children and explanations are given of their meaning to the child and to the adults surrounding him.

Lowrey has accomplished in this book the goal which he expressed in the preface, namely, "to present the indicator symptoms of deviation in mental functioning, with special reference to differential symptom pictures which help the social worker in her task of reaching some conclusions with respect to the types of situations in which she needs expert advice, when special types of placement or treatment are necessary, or where she may safely undertake supervision or a treatment plan of her own."

HELEN HEWITT ARTHUR

MODERN CLINICAL PSYCHOLOGY. *McGraw-Hill Publications in Psychology.*

By T. W. Richards. McGraw-Hill Book Company,

New York and London. $3.50. xii + 331 pp. 1946.

The objective of this book, as stated in the preface, is to improve the intuitive capacity of the student of psychology. To accomplish this praiseworthy but questionably feasible objective, the organization follows a definite scheme, which has some advantages for the reader, but is most confusing in any attempt to follow the treatment of a specific topic. For example, the Rorschach test is discussed—and in a different connection each time—in no less than sixteen different places in the text, at sufficient length to justify inclusion in the index. This makes also for undue tautology.

The scheme of the organization, following five opening chapters orienting the reader to the specific field of clinical psychology, is a discussion of (1) appraisal of capacity, (2) appraisal of motivation, and (3) appraisal of control. As pigeonholes these topics have merits, but they appear to be bulging slightly from the author's efforts to cram a whole dynamic clinical psychology into these three slots. Illustrating the overflow are the two concluding chapters (Precipitation and Predisposition; Readjustment), constituting a refutation of the organization of the whole text. The general impression is one of flesh adhering very loosely to skeleton.

The actual discussion of clinical psychology appears to be subordinated to that of abnormal psychology. Certainly, case material is extremely valuable to illustrate theories and ideas, but much of the case content is dragged in, not very pertinently, and one wonders why so high a percentage of it has been borrowed from other texts, and almost no contribution in this area made by this book itself. There are 24 case reports listed in the index, of which all but two or three appear to be borrowed. For example, one long discussion of a homosexual (12 pages) is borrowed from Henry, and 21 pages of transcription of non-directive therapy comes from Madigan.

Despite the flaws just noted, this reviewer has tried the book as a textbook in an undergraduate course in Clinical Psychology and has found the students liking it (or saying they did), if requiring a great deal of elucidation and glossing. An appendix includes a list of the nomenclature of mental disorders adopted by the American Psychiatric Association in 1933; a good bibliography of 148 titles documents the text, and a worthwhile addition is a list of visual aids, with sources.

ARTHUR LICHTENSTEIN

PSYCHIATRIC INTERVIEWS WITH CHILDREN.

Edited by Helen Leland Witmer. The Commonwealth Fund, New York; Geoffrey Cumberlege, Oxford University Press, London. $4.50. x + 443 pp.; ill. 1946.

This is a very practical volume, in which a successful effort has been made to report what actually happens with children in child guidance clinics. Helen Witmer has done an intelligent job of collecting and editing actual case reports from ten well-known therapists. She has also done an important preliminary job of introducing the reader to historical facts and contemporary concepts of child guidance. While she describes the full clinic "team" of therapist, social worker, and psychologist, her emphasis is primarily on how the psychiatrist functions in this setting and with what type of patient. The last two chapters of her introductory section, which deal respectively with the selection of patients and the dynamics of the therapeutic relationship, are particularly helpful.

Part II is devoted to actual case studies. The selection of material was done thoughtfully, with the idea of choosing varied but representative patient problems which were successfully handled in therapy. Each therapist, following the editor's clear but never rigid pattern of emphasis, has written up his own case. Frederick H. Allen, Phyllis Blanchard, Lydia N. G. Dawes, Hyman S. Lippman, Martha W. MacDonald, H. B. Moyle, Beata Rank, and Robert A. Young are the contributors. After a summary of the problem presented and a discussion of how treatment was visualized at the beginning of the contact, the authors report the hour by hour twists and turns of the therapeutic process within the child. The wealth of detail about the child's response and the frankness with which the psychiatrist relates his actual handling of the case gives the reader a real sense of participation. This effect of an inside view is further enhanced by running interpretive footnotes, which let the reader know how the therapist senses the case as it develops.

Despite the large number of contributors, this book has a coherence of both subject matter and style that is a real achievement. And it is never dull. It is a book which should be read by all who are doing or who intend to do psychiatric work with children. Many others, in a variety of related fields, will also enjoy and be stimulated by the volume.

HELEN HEWITT ARTHUR

THE PSYCHOANALYTIC STUDY OF THE CHILD. *Volume II, 1946. An Annual.*

Edited by Phyllis Greenacre, Heinz Hartmann, Edith B. Jackson, Ernst Kris, Lawrence S. Kubie, Bertram D. Lewin, Marian C. Putnam, Rudolph M. Loewenstein, René A. Spitz, Anna Freud, Willie Hoffer, and Edward Glover. International Universities Press, New York. $7.50. 424 pp. 1947.

This is the second volume of the projected annual publication of significant psychoanalytic papers dealing with child problems. Again one is impressed with the sincerity and seriousness with which the editors have selected the material. It is also impressive how much a

common theoretical approach unifies a book actually written by twenty individualistic authors.

The papers are loosely grouped under five headings. The first section, Problems in Child Development, is comprised of six papers which vary greatly in length and reability. Jeanne Lampl de Groot has a stimulating paper here on The Pre-oedipal Phase in the Development of the Male Child. She calls attention to a period of female identification which boys commonly go through prior to the Oedipal phase and suggests that this developmental experience may explain certain aspects of adult maladjustment.

Part II, by far the most interesting section, contains eleven fascinating studies on Clinical Problems. Infantile feeding disturbances, psychogenic tics, reading disabilities, enuresis, and childhood psychoses are some of the entities discussed dynamically by such well-known analysts as Anna Freud, Margaret Gerard, Phyllis Blanchard, to mention only a few. There is also a reprint (translation) of Waelder-Hall's classical paper, The Analysis of a Case of Night Terror, the first child analysis to be reported in detail. Originally presented in 1930, it is still a vital case study.

Parts III and IV, entitled Guidance Work, and Problems of Education and Sociology, respectively, are not very good. The three papers included, while not exactly vapid, seem verbose and their points either over-emphasized or diffused.

The last paper (under History of Child Psychiatry) is a report on J. B. Felix Descuret, a French M.D. of the last century who made some very pertinent observations of emotional reactions in his child patients.

Volume II thus includes some very excellent papers. On the whole, however, it is not quite such an effective work as Volume I, which actually set an exceedingly high standard for succeeding volumes to equal. This comparison, though, should not conceal the fact that both volumes represent real contributions to modern child psychiatry and belong in the library of those interested in that field.

HELEN HEWITT ARTHUR

MEN AND THEIR MOTIVES: *Psycho-Analytical Studies. By J. C. Flugel, with two essays by Ingeborg Flugel. International Universities Press, New York.* $5.00. vi + 290 pp. 1947.

This book consists of eight disparate essays, only one of which has not appeared previously in either *The British Journal of Medical Psychology*, the *International Journal of Psychoanalysis*, or *The Psychoanalytic Quarterly*. Despite the wide variety of subject matter, however, there is a consistency of style and intellectual approach (found, indeed, even in the two papers contributed by the author's wife) which produces a feeling of unity within the entire work. Probably the fact that Flugel adheres in each paper to a systematic development of the unconscious motives involved accounts for the surprising coherence of this volume. Such a series of studies points up the real relationship between all unconscious motivations whatsoever, whether they are concerned with current attitudes toward birth control, the international language movement, or the character and married life of Henry VIII—all issues dealt with in the book. In addition to these subjects, Flugel makes learned and searching observations on Sexual and Social Sentiments, Some Problems of Jealousy, and on a train of thought provoked by Maurice Bedel's book *Jerome*.

There is no doubt that Flugel exemplifies the highest type of scholarly and, at the same time, original thinker. The fact that his thinking is oriented toward psychoanalysis is a tribute to that field. While his writing, dealing as it does with many abstract concepts, does not make for facile reading, it is logical. There are real rewards for the intelligent student who will take the time to follow the author's thoughts to their conclusions.

Flugel's work has long been regarded as a classical contribution to psychoanalytic thinking. In fact, the papers in this volume were first published by a London house in 1934. It has remained for the recently expanded interest in psychoanalysis in this country to make the book available here. Despite the lapse of time, however, there is nothing dated about the material. It remains as provocative, as constructive, and as currently applicable as when it was first published. Perhaps it is even more valuable, now that psychiatry as a whole is more receptive to the concept of unconscious motivations.

HELEN HEWITT ARTHUR

HYPNOTISM TODAY.

By Leslie M. LeCron and Jean Bordeaux. Foreword by Milton H. Erickson. Grune & Stratton, New York. $4.00. x + 278 pp. 1947.

This is a well rounded and practical discussion of hypnotism as revealed in the current literature, illustrated by the authors' own observations. To aid in the understanding of the peculiar attitude commonly held toward hypnosis, a historical background is first presented. Methods of inducing the hypnotic state are enumerated, both in general principle and in very specific application. The major phenomena observable under hypnosis are described, and then the use of the technique in the treatment of a variety of disorders is considered. Finally, some suggestions are made regarding the orientation of future research.

The text is well documented, and the writers are generous with concrete examples from their professional practice. Thus the material strikes the reader as reasonably authoritative. However, there are a

number of characteristics, some of style and some of underlying logic, which may irritate certain readers, may lead others to adopt a cautious and tentative attitude toward the proffered interpretations, and may perhaps cause a few to discard the book completely. More than one controversial issue seems to have been settled by an a priori decision, and then any contrary evidence either vaguely explained away or disregarded altogether. Whenever the findings of Hull and Erickson come into conflict, it is safe to predict that the former experimenter will be dismissed as an amateur. Particularly distressing to the psychologist is the apparent misunderstanding and misuse of certain terms and principles of current non-hypnotic psychology.

The section on hypnotherapy, although spread thinly over too many pages, should be challenging to a wide audience—physicians, physiologists, psychologists. There appears to be abundant demonstration that a considerable variety of human ills, not only of so-called functional origin but also of organic nature, can be relieved during the trance state. The hypnotized patient must first be persuaded to accept the faith that the treatment will be successful, at the same time developing a genuine desire to be cured. Next, incessant suggestion is given that the symptoms will disappear. In cases with emotional involvement, the therapist must lead the patient toward increased insight into the etiological dynamics of the situation. And finally, help must be given in the building up of new and healthful habits of thought.

It should perhaps be said that some of the theoretical discussions of LeCron and Bordeaux are open to argument, and that critical judgment must be exercised in their evaluation. But it is equally true that the data submitted are well worth examination if an adequate conception of the present status and future possibilities of hypnotism is desired.

FRANK W. FINGER

THE PERSONALITY OF MAN: *New Facts and Their Significance. Pelican Books.*

By G. N. M. Tyrrell. Penguin Books, Harmondsworth, Middlesex. 1s. (paper). 295 pp. 1946.

Before the average reader finishes this book, he may suspect that by some queer accident of publishing the content and title of two different volumes have been shuffled, and that somewhere a comprehensive treatise on personality must be skulking along under the alias of *Psychical Research as an Antidote to Materialism.* Certainly he will be disappointed if he expects to find in *The Personality of Man* an analysis of the subject defined by Allport in his *Personality,* or by other American psychologists in their briefer textbook discussions.

The motivation of this book seems to stem from the conviction that all is not well with the world, and that the root of the evil is a materialism fostered by a blind faith in modern science—or in modern scientists. In search of a substitute, Tyrrell turns to so-called parapsychology, which is depicted as furnishing proof of a nature and destiny of human individuals presently invisible to established science. Inspiration and genius, mysticism, telepathy, and foreknowledge are considered in terms of anecdote and laboratory study. The hesitation of the majority of scientifically inclined psychologists to accept the implications of parapsychological experiments is appraised in the light of the scientific method itself, and is dismissed as being an emotional shrinking from the unfamiliar. The conclusion is reached that parapsychology, as it takes us into the realm of the unknown, opens up the philosophical possibility that materialism must be repudiated, and that life may be worth living, after all.

That the present state of human society leaves something to be desired will probably be accepted with little argument. A number of alternatives have been suggested as possible remedies: a moratorium on physical science, an acceleration of the scientific study of social problems, a deeper acceptance of some religious or philosophical schema, a revision of the economic system, a broadening and vitalizing of the educational process. The reasons for adding to this list the endowment of laboratories for parapsychological research are interesting, but the speculation is short of convincing. It is a long leap from card-guessing and cross-correspondence puzzles to an improved private or international morality.

FRANK W. FINGER

PSYCHIC SCIENCE AND SURVIVAL.

By Hereward Carrington. The Beechhurst Press, New York. $2.50. 142 pp. 1947.

The thesis of this popularly written book is that psychic science is the only hope for the survival of the church, that it furnishes the only evidence for the reality of the soul, and that it provides the only satisfactory basis on which a meaningful Cosmic philosophy can be built. There is no systematic argument regarding the validity of psychic phenomena. Rather, Carrington presents two lists: "scientifically proved" are telepathy, clairvoyance, psychometry, apparitions, dowsing, telekinesis, psychic raps, and psychic lights; "so nearly established as to constitute virtual proof" characterizes premonitions, haunted houses, the astral body, psychic powers of animals, materialization, levitation of the human body, and spirit communications. In the light of these demonstrations, a superphysical world must be admitted to exist, and the most logical explanatory theory is that the personality survives in some form after the death of the body.

For one seeking a scientific evaluation of the evidence for "super-normal phenomena," further sources must be consulted. But here may be examined some sug-

gestive implications of these phenomena,—*if* they are real,—implications of considerable import both to the individual and to science itself. At the same time, the reader may be interested in the analysis by this psychic researcher of the reasons why so many conventional scientists scoff at the evidence. And between the lines there may perhaps be detected certain opposing and equally insidious motivations that predispose other individuals to embrace the "superphysical" interpretation.

FRANK W. FINGER

HUMAN BIOLOGY

SOCIOLOGY. *McGraw-Hill Publications in Sociology. By Richard T. LaPiere. McGraw-Hill Book Company, New York and London.* $3.75. xvi + 572 pp. 1946.

SOCIETY IN THE MAKING.

By M. N. Chatterjee. J. W. Edwards, Ann Arbor. $2.00 (paper). x + 190 pp. 1946.

Sociology is the youngest of the sciences. Although attempts have been made to integrate and systematize the observations that man has made on his own gregarious nature, the results of these attempts have not always proved satisfactory. Most sociologists of the past have failed to recognize that sociology is in reality a branch of biology and that any system of sociology which lacks a biological foundation is like the house built upon the sand.

Furthermore, in sociology, like psychology, the observed object is also the observing subject. Most of the natural sciences have developed from man's contemplation of the environment about him, and this environment is not changed by the contemplation. But when man contemplates himself he develops himself. It follows that man's sociological evolution must be more complex than his organic evolution, for the latter has been brought about by the interaction of only two sets of factors, over neither of which he exercises conscious control: his heredity, derived from the past, and his environment which is in the present. But his sociological evolution involves a third set of factors: his behavior. This is largely teleological, being consciously shaped to bring about a desired end, and so belongs to the future.

To the reviewer the presence of teleological factors in evolution appears to be an essential, though not necessarily a sufficient, condition for the establishment of a normative science. The fundamental difference between the two works covered by this review is that one develops a descriptive, and the other a normative, science. The first seeks to answer the question, How does man actually live among his fellow men? and the second, How ought man to live among his fellow men?

Both writers seem to be adequately grounded in those biological fundamentals which are a prerequisite to the erection of a superstructure of sociology, and they both have the ability to express themselves lucidly for the reader of average intelligence—an ability too often lacking in the leaders of modern scientific thought. Because these two authors approach their subject matter from different vantage points, their works are complementary. The student who reads them conjointly will get a stereoscopic view of human relations that cannot be achieved by reading them separately. In this case the whole is greater than the sum of its parts.

AN INTRODUCTION TO SOCIAL BIOLOGY.

By Alan Dale. William Heinemann, Medical Books, London. 15s. viii + 396 pp.; ill. 1946.

Textbooks of so-called human biology have appeared before, but this is the first I have seen really to deserve the name. It is the most original and interesting presentation I have met with. Prepared for the Sixth Form of a large boys' secondary school, it compares favorably with American college textbooks for beginning courses in biology. Well printed on excellent paper, its half-tone illustrations achieve a clarity and contrast all too rare in elementary textbooks.

The treatment of the subject begins with a consideration of Life in Space and Time and proceeds to Man and Evolution. The third chapter, headed Man as an Animal, surveys very concisely the anatomy and physiology of the human being and stresses the study of behavior. The next three chapters form a unit on the maintenance of the human species, dealing (a) with Sex, (b) with Inheritance, and (c) with Reproduction. Comparative aspects are not neglected. Two chapters on Man and His Health follow: (a) on Social Hygiene, (b) on the History of Medicine. These are very well done. The remaining chapters cover the subjects of Food and Drink, The Balance of Nature, Social Life Among the Animals, Some Reasons for Man's Success, and The Nature of Life. Suggestions for further reading and an index complete the volume.

There are, of course, minor errors. These are remarkably few in comparison with those in most first editions of college biology textbooks, however—while the superb originality of organization and treatment would atone for many more than actually exist. The discussions are meaty and thought-provoking. A fine grasp of the historical development and significance of science is met throughout. The book, small in comparison with most college and high school biology textbooks, far outweighs them in social and educational significance. It should have the widest encouragement.

BENTLEY GLASS

WOMEN IN INDUSTRY: *Their Health and Efficiency. Issued under the auspices of the Division of Medical Sciences and the Division of Engineering and Industrial Research of the National Research Council. Prepared in the Army Industrial Hygiene Laboratory.*

By Anna M. Baetjer. W. B. Saunders Company, Philadelphia and London. $4.00. xii + 344 pp. 1946.

This is a carefully prepared, analytical review of the available information, and particularly that gained from war-time experiences, relating to the health and efficiency of women employed in industry. The main body of the book consists of six sections. The first of these deals with the ability of women to perform work and with the types and conditions of work, including placement policies. This section is followed by discussions of sickness and absenteeism, accidental injuries, and occupational diseases, and comparisons are made with the same or similar conditions occurring among males. The relation of gynecological and obstetrical problems and of fertility and mortality to occupation is then considered in some detail. The text is completed with ten pages that summarize the material of all six parts. The appendices contain a good deal of data concerning the numbers of gainfully employed women, the suitability of occupations, and relevant legislation. There is an extensive bibliography.

This work is a unique and timely contribution to the literature of industrial hygiene and will undoubtedly be a valuable reference book for those interested in public health. In addition, it is well worth consideration for general reading, for it is a thoroughgoing presentation of a subject of increasing importance.

HARRIETTE D. VERA

THE PHILOSOPHY OF WAR AND PEACE.

By Albert C. Knudson. Abingdon-Cokesbury Press, New York and Nashville. $2.00. 221 pp. 1947.

This book lives up to its name well. It is the best exposition of the philosophies of war and peace the reviewer has ever read. The author is not a pacifist, a fact which lends great weight to the book. The pacifist, like the militarist, is committed in advance to the support of his theories, for which reason one is compelled to discount all discussion of either pacifist or militarist doctrine as propaganda. But the arguments of a writer who is not committed to saving his face cannot be dismissed so readily. In his preface the author states that he has sought to be objective and dispassionate, and that therefore he expects to satisfy neither the thoroughgoing militarist nor the absolute pacifist. Yet just because he has succeeded in being so objective and dispassionate, the pacifist is likely to obtain far more aid and comfort from his work than the militarist. This is due partly to the fact that the author's thought seems much keener in his analysis of the philosophy of peace than in that of war, but it is due chiefly to the fact that the famous peace plans of history have been the work of men whose mental calibre, as a group, was superior to that of the apologists for war.

The author discusses in detail fourteen different plans to insure international peace, beginning with *De Monarchia* by Dante Alighieri and published sometime prior to 1321, and ending with the *Institutes of the Law of Nations* by James Lorimer, published in 1884. Against these, the only writer who seems to have published anything on the other side is the infamous Machiavelli. Even such militaristic writers as Treitschke, Nietzsche, and Hegel did not seek to establish warfare as a permanently enduring international condition, but only to justify recourse to it in preference to more peaceable methods of settling international differences.

In his opening chapter the author has considered various attempts to rationalize warfare, and it is interesting to note that, while he makes no attempt to demolish the arguments of the peace planners, he demolishes very effectively every argument advanced by those who advocate recourse to war. He merely suggests that the peace plans have not succeeded because they have not been tried—surely a sane and reasonable statement. If the nations would spend on peace only a small fraction of the money, activity, and cerebration which they are now expending to pay for old wars and to prepare for new ones, there would be "no need for arsenals or forts."

The book appears to have a few weak points. The omission of any reference to Jonathan Dymond's famous essay is one of them. Another is the author's belief that war goes back to the beginning of the human race. The fact that there is nothing resembling war among the anthropoid apes makes it seem more likely that man was originally a peaceable animal who acquired militarism in the course of his social evolution. While this point is of little importance, the next one is not. The author states that "the considered moral judgment of mankind recognizes no fundamental difference between the coercion exercised by the police force and that exercised by the army." This statement seems completely fallacious, since the functions of the army and the police are diametrically opposed. To realize that this must inevitably be the case one need only recall the statement, attributed to an officer of the national guard in criticising the delegation of that organization to police the border in 1916, that military training unfitted men for police service, or to remember that when a recent unsuccessful presidential candidate was said to have suggested the use of the army as a domestic police force, he was promptly rebuked on the ground that such a plan would be unconstitutional. The fundamental difference between the use of coercion

by the army and by the police was elucidated a few years ago in a pamphlet distributed by the Fellowship of Reconciliation, and written by C. J. Cadoux. It is unfortunate that this item was overlooked when the voluminous and enlightening bibliography was compiled. The difference is, of course, that the function of the army is to participate in a controversy, while that of the police is to maintain order. The one is like a pugilist in the ring, the other like the referee. The one says, "My country, right or wrong," and the other says, "May the best man win." The battlefield never decided which of two nations was in the right, but only which was the stronger.

The blurb on the cover states that this work is a clear, compact, introductory study of a question that may be the most vital of all time, and recommends its use among churches, clubs, and small groups. With this sentiment there must be complete accord.

THE JEWISH PEOPLE: *Past and Present. Volume 1. Jewish Encyclopedic Handbooks, Central Yiddish Culture Organization (CYCO), New York.* $10.00. xvi + 430 pp. + 9 plates; text ill. 1946.

To anthropologists, ethnologists, and biologists interested in the origins and mixtures of human races and peoples, this volume will offer considerable matter for thought. The first article is a contribution by M. F. Ashley Montagu on Race Theory in the Light of Modern Science, in which he reiterates his well-known critique of racial theory regarding man. In short, following Dobzhansky's definition of race, he would discard the concept as quite inapplicable to man, and substitute for it the term "ethnic group," meaning thereby one of a number of human populations which individually maintain their differences, physical and cultural, by means of isolating mechanisms such as geographic and social barriers. These vary in strength from place to place and time to time and so permit the intergrading and hybridization of the ethnic groups. Measured by this concept, the Jews are to be classed not as a single ethnic group, nor even as several, but as members of a common culture. The second contribution to the volume, The Anthropology of the Jewish People (J. D. Bretzkus) supports this judgment with evidence of the diversity of the Jews in anatomical and physiological characteristics, physiognomy, gestures, etc. The blood group comparisons are particularly convincing. Jews from different parts of Europe show a great diversity in the frequency of specific blood types, whereas highly inbred "isolates," such as the gypsies or the Germans of Hungary still closely resemble after many centuries the peoples of their respective origins in their blood group frequencies. There are two basic types of Jews, the Oriental and the Western Asiatic; but through centuries of migration and intermixture with other peoples, the European Jews are best classed (geographically) as (1) the Jews of the Mediterranean countries; (2) the Jews of Western Europe; (3) the Judaeo-Khazar groups in the Crimea, Caucasus, and Central Asia; and (4) the Eastern European Jews of Poland, Lithuania, Russia, and Romania.

The history of the Jewish people, both archeological and written, is outlined by Wm. F. Albright, E. L. Sukenik, A. Menes, and A. Steinberg. The major portion of the volume, following these contributions, is then filled with studies of the Jewish religion. At the end of the book, along with some reviews of the economic and social development of the Jewish people, there are two further contributions of biological interest: The Jewish Population of the World (Arthur Luppin), and Jewish Migrations During the Last Hundred Years (L. Hersh). In 1939 the population of Jews was reckoned at 9,462,000 in Europe; 5,556,000 in North and South America; 1,008,000 in Asia; 594,000 in Africa; and 28,000 in Australia and New Zealand; a total of 16,648,000. 4,870,000 of these (33.4%) lived in the United States of America. The great emigrations to the U. S. and in recent years to Palestine are fully recorded.

The book is well printed and superbly illustrated, including a number of color plates; but the binding is none too substantial.

BENTLEY GLASS

PALESTINE: *Land of Promise. Revised Edition. By Walter Clay Lowdermilk. Harper & Brothers, New York and London.* $2.50. xii + 244 pp. + 16 plates. 1944.

The dark green citrus groves with their red tile-roofed white residences and farm buildings, and the dazzlingly white modern Jewish towns scattered over an otherwise drear and depressing stony landscape made a great impression upon the author, as they do upon every traveller by air who comes upon Palestine after crossing the wastes of the Syrian desert.

Since ancient times Palestine has been the corridor between important centers of population and civilizations. And it continues to be in the tension zone between powerful nations, and between the nomadic tribes of the desert and the settled tillers of the soil and their associated artisans. Considerable space is given to describing the unusual collective agricultural and industrial colonies, and to showing that in spite of the urban and white-collar background of many of the colonists, they have been remarkably successful in developing productive and going enterprises in Palestine.

This beautifully printed book is especially helpful now that the questions of the rights, privileges, and

obligations of the Jews and the Arabs are being debated in the press and in the United Nations. The author claims that the Arabs individually and in their village life and agricultural practices have benefited markedly as a consequence of the development of Palestine by the Jews, and that this is shown by public health and economic conditions. By contrast, the influential Arab landlords and politically minded leaders are the ones who so strongly oppose an increase in the number or influence of the Jews in Palestine.

The author's original proposal for a "Jordan Valley Authority" seemed visionary. He had suggested that the waters of the Jordan and other streams should be used more effectively for irrigation and land reclamation; and further, that the waters of the Mediterranean should be brought through the mountains in tunnels and used for the development of electric power by the fall of over 1200 ft. down to the level of the Dead Sea. This would also maintain the level of that lake at approximately its present position and make possible the continued exploitation of the dissolved salts in its water. However, this new edition includes a chapter summarizing essential features of the report of an engineering board appointed to study the possibilities of this "authority." It appears that the engineers are even more optimistic over the project than was the author.

In discussing the absorptive capacity of Palestine, the author states that during the past 25 years not only have almost half a million Jews been settled in the country, but that the Arab population has doubled. As to the future, with the full utilization of the "authority" for reclamation and power, it is considered possible to absorb at least 4 million Jewish refugees from Europe in addition to the 1,800,000 Arabs and Jews already in Palestine and Trans-Jordan. "On 14 per cent of the cultivated area and 6 per cent of the total area of Mandated Palestine, a people with faith and devotion born of long tradition has changed desolation into fertile fields, fruitful orchards and reforested slopes. Ancient cities have been rebuilt and the commerce of their streets quickened, long-unknown resources have been brought into the light of day and sent to the distant marts of the world. After the centuries of darkness which crushed the hopes of Palestine's miserable inhabitants, a new force has come into the land and made it live again. The possibility of a new day for the entire Near East is hidden in the fertile lands, the flourishing villages and cities, the co-operatives and the factories of Jewish Palestine. If the forces of reclamation and progress Jewish settlers have introduced are permitted to continue, Palestine may well be the leaven that will transform the other lands of the Near East. Once the great undeveloped resources of these countries are properly exploited, twenty to thirty million people may live decent and prosperous lives where a few million now struggle for a bare existence. Palestine can serve as the example, the demonstration, the lever, that will lift the entire Near East from its present desolate condition to a dignified place in a free world."

ROBERT L. PENDLETON

ANTI-SEMITISM: *A Social Disease.*

Edited by Ernst Simmel, with a preface by Gordon W. Allport. International Universities Press, New York. $2.50. xxviii + 140 pp. 1946.

This extremely well written compilation represents another effort by the psychoanalytical movement to explain—at least to its own satisfaction—the rather well worked-over problem of anti-Semitism. A glance at the little biographical sketches about the authors indicates that there is no lack of properly trained analysts and sociologists in the group that made the contributions; included are: Otto Fenichel, Douglas Orr, B. Berliner, Ernst Simmel, T. W. Adorno, Gordon W. Allport, and Max Horkeimer.

This work received impetus from the Nazi persecutions, which were to the student of anti-Semitism like waving the traditional red flag before a bull. A current incentive to read the book is the turmoil in Palestine, which is nurturing another wave of anti-Semitism. This collection originated from a symposium on the subject arranged by the San Francisco Analytical Society because "we considered it our duty to the immediate community—as well as to the larger community of the world—to submit the problem of anti-Semitism to the scrutiny of unbiased science." The symposium met in San Francisco in 1944, and the book is the result of the discussions, well edited by Ernst Simmel.

Considering what prejudice is, the problem was posed, as one reads the book: "How many individuals do examine their opinions?" *Anti-Semitism* paints a vivid picture of the dynamics to be discerned through the glass of psychoanalysis. Such pertinent factors as the repressed lust to kill, the love of dirt, and low voluptuousness are kept hidden in the unconscious but strive to get out into the open, and therefore, can be projected upon the Jew. At the basis of the individual obsessional ideations of anti-Semitism is the latent homosexual complex.

The section on mass psychopathology is well handled. It is shown how in a mob one can use mob psychosis as an excuse for the breakdown of the individual ego. Mob psychosis also offers an approach to the understanding of the mental defense mechanisms against the recognition of one's own guilt. Orr, who wrote this section brilliantly, elucidates many of the Jewish customs which have been seized upon by racially prejudiced people. He works out well, in an analytic sense, the Jewish custom of eating a freshly killed lamb on

Passover, and how the lamb is taken to represent the devouring by the Jews of the lamb-like Christ. He interprets Hitler's desire for a pure Aryan race as an unconscious perception that basic human hatred drives people to desire to incorporate each other by devouring.

The results of the Rorschach and the Thematic Apperception Test on known anti-Semitic personalities among college students revealed principally that such persons are insecure people, afraid of losing their social status. This serves to release their inhibitions and to cause them to act like Jews, and so further to jeopardize their social standing. Anti-Semitism is for them a method to maintain their identification with the middle class and so to avoid anxiety.

Emotional security, self understanding, and maturity are offered as antidotes to the trend. The question arises: How can such an immense program be started and accomplished? It is an accepted fact that anti-Semitism has its origin in childhood, when a child identifies himself with the attitudes of his parents, and refuses to allocate his hate, developing a prejudice against all Jews because some little Jewish child would not lend him some toys, or beat him up in a fight. Co-operation would be received only from those who have little or no racial bias already.

To conclude: *Anti-Semitism* is well written and replete with theories acceptable in most psychoanalytical circles, and it can be read with understanding by those who have a psychoanalytical orientation and can derive something from the book to support their own conclusions.

ROBERT MAZER

ZENTRALEUROPAS ALPWIRTSCHAFT. *Volumes I and II. Instituttet for Sammenlignende Kulturforskning, Series B, XXXVIII.*

By John Frödin. H. Aschehoug & Co. (W. Nygaard), Oslo; Kegan Paul, Trench, Trubner & Co., London; Otto Harrassowitz, Leipzig; Société d'Édition "Les Belles Lettres," Paris; Harvard University Press, Cambridge. (I) N. Kr. 20.00; (paper) N. Kr. 15.00. (II) N. Kr. 25.00; (paper) N. Kr. 20.00. (I) xxx + 411 pp.; ill. (II) viii + 583 pp.; ill. (I) 1940; (II) 1941.

Europe's dairy industry, unlike ours, is situated primarily in mountainous regions and is connected with a very old economic set-up, the so-called "Alp" or "Senn" economy. The "Alp" is a settlement in the high mountains, inhabited by man and livestock only in summer and therefore assimilated to semi-nomadic forms. John Frödin, who had earlier studied these establishments in his native Scandinavia, has now concentrated in this monumental work the experience and results of two decades of fieldwork in Central Europe, surveying simultaneously an extensive literature on the subject. The book deals with the "Alps" in the Giant mountains of Silesia, the Black Forest, the Vosges, the Swiss Jura and Alps, the French Alps, and the Eastern Alps, divided politically between Austria, Italy, and Yugoslavia.

The starting point for the author is in every case the geographic situation, which has created and modified this particular economy. But all other aspects—technical ones like the different forms of migration and settlement, the kinds of animals cultivated, the kinds of product (milk or meat) envisaged, as well as such economic-social aspects as the different forms of ownership (communal or individual), size of enterprise, etc.—are most carefully examined.

It is impossible to do justice to this classic of human geography in a short review. But special mention should at least be made of the more than two hundred illustrations, all collected by the author himself, that form an integral and not the least valuable part of an invaluable book.

ERWIN H. ACKERKNECHT

THE BANTU TRIBES OF SOUTH AFRICA: *Reproductions of Photographic Studies. Volume III, Section IV, The Nguni: Section IV, The Swazi. With an Introductory Article on the Swazi and Descriptive Notes on the Plates.*

By A. M. Duggan-Cronin; introductory article and notes by Hilda Beemer. Deighton, Bell & Co., Cambridge, Eng.; Alexander McGregor Memorial Museum, Kimberley. 25 s. (paper). 32 pp. + 32 plates. 1941.

This monograph on the Swazi makes part of a many-volume iconography of the Bantu tribes of South Africa. The 32 pages of text are very interesting and substantial, giving a short outline of the colorful history of the tribe; the peculiarities of its feudal political structure, wherein power is divided between the king-mother and the king; its economy; its (polygynous) family life; its age hierarchy; and acculturation problems. The 32 plates are excellent, yet insufficient in scope and too statuary to give a real impression of tribal life.

ERWIN H. ACKERKNECHT

INDIANS BEFORE COLUMBUS: *Twenty Thousand Years of North American History Revealed by Archeology. A Contribution of the Chicago Natural History Museum.*

By Paul S. Martin, George I. Quimby, and Donald Collier. The University of Chicago Press, Chicago. $6.00. xxiv + 582 pp. + 1 plate; text ill. 1947.

The authors state that this book was written for the interested layman and for students taking introductory

courses in anthropology and that it is not intended as a general reference book for professional anthropologists. The form of the book, however, is much more like that of a reference book. It is systematic, factual, and extremely compressed. Archeology is defined, and the origin of the American Indians is discussed in a section called Background. There are sections on Arts and Industries, The Earliest Indians, The Southwest, Eastern North America, The Pacific Slope, The Far North, and a concluding chapter on Chronology and Correlation of Sequences of Cultures. The work makes a fairly handy reference, but is very dull reading. This is due to compression and the shoals of facts. It is added to by the almost catechism-like style. As an example: "Did the evolution of our modern corn varieties require a long time? No, it did not."

One is made a bit uneasy about the book by the lack of specific citation of papers and the quite arbitrary inclusion or omission of papers. In short, the book suffers from having undertaken too much, and from having presented it too didactically.

GEORGE F. CARTER

ALASKA BECKONS.

By Marius Barbeau; illustrated by Arthur Price. The Caxton Printers, Caldwell, Idaho; The Macmillan Company of Canada. $4.50. 343 pp. + 1 plate; text ill. 1947.

This handsome book can be recommended as good reading. The author is a long-time student of the Indian peoples of Alaska and adjacent Canada. In his book, he has brought together many of the myths of these Indians and has told them well. In Barbeau's hands these myths become the records of the movements of peoples from Siberia into America and their persistent seeking of better lands to the south. The work is interpretive, imaginative, and often poetic. Yet underlying it is a wealth of knowledge of the native peoples of this area. The book is illustrated with striking woodcuts done in the native style of the Northwest Coast Indians.

GEORGE F. CARTER

MAN IN NORTHEASTERN NORTH AMERICA. *Papers of the Robert S. Peabody Foundation for Archaeology, Volume Three.*

Edited by Frederick Johnson. The Robert S. Peabody Foundation for Archaeology, Phillips Academy, Andover, Massachusetts. $2.00 (paper). xii + 347 pp. + 1 plate + 2 charts; text ill. 1946.

This volume is the result of collecting a group of papers by specialists in the area. It has the usual virtues and shortcomings of such collections. Some of the papers are highly specialized, some quite general, some long, some short, and depending on the interest of the reader, some are uninteresting and some stimulating. In general, it is a useful collection that brings together much material and makes available in one volume a rather good over-all survey of the status of the problem of man in northeastern America.

The subjects treated are: the environment, archeology, physical anthropology, linguistics, psychology, mythology, general culture. Among the more interesting papers are W. W. Howells' treatment of physical types, A. I. Hallowell's treatment of psychology, and John M. Cooper's reconstructive interpretation of the culture of the Northeast.

Howells points to the general validity of the earlier studies that established this area as one characterized by a long-headed population. He points out that it is possible to divide the area into two slightly differing populations; that there are some islands of round-headedness; and points to the general American succession of long heads to round heads. Hallowell has done a most interesting job of using the Jesuit relations and other early descriptions of the Indians to make an analysis of their psychology. One of the interesting outcomes of this is a most reasonable explanation of the action of the Indians when drunk. Their actions are explained as the result of the liquor releasing a severely repressed person. Cooper's reconstruction of the culture of the Northeastern Indians is of interest for its world-wide view and great historical depth. He particularly examines the theoretical sequence from ice-hunting to snowshoe hunting and finds the evidence that the ice-hunting stage is the earlier is unsatisfactory. The other papers are generally less biological and more specialized.

GEORGE F. CARTER

THE LAST TREK OF THE INDIANS.

By Grant Foreman. University of Chicago Press, Chicago. $4.00. 382 pp. + 1 plate + 8 maps. 1946.

Every history of the United States that has ever been written has come from the pen of a Caucasian writer. The Indians' side of the story has never been told and never can be. Even though the historian is actuated by a desire to present the facts truthfully and impartially, and even though he may recognize the treatment of the American aborigines as the greatest disgrace in our national history, he cannot think as an Indian and look through his eyes.

In Latin America generally, the assimilation of the races is being brought about by the fusion of the two cultures, but north of the Great River the exotic culture is rapidly obliterating the native one. Although the North American Indian is increasing numerically, he is at the same time ceasing to be Indian.

The author of the present work is an attorney who was formerly employed by the Dawes Commission to classify the lands of the Indians in Oklahoma, and who became so interested in them that he undertook to recapture their own story before it was lost forever. The volume is not pleasant reading. The dishonesty of the white settlers in stealing the Indians' livestock and raiding their crops, the cupidity of the predatory traders who supplied the Indians with fire-arms and fire-water and infected them with smallpox, the incompetence of the agents to assume the responsibility vested in them to safeguard the interests of their wards, and the indifference of the authorities in Washington as to whether the contracts entered into by Congress were ever carried out or not, all add up to make the story of the evictions the greatest stain on our national honor, and one that cannot be erased by the reforms that have been initiated during the earlier years of the present century.

The first attempt to correct the mismanagement of Indian affairs came during the administration of President Grant, and expressed itself in the establishment of the Board of Indian Commissioners, "a body of persons of standing and influence, who served without pay as observers, conscience, advisers to the President and the Office of Indian Affairs." The reviewer is the great-grandson of the chairman of this board, and he imagines that he can recognize some of his ancestor's writing in the reports of the Commissioner of Indian Affairs quoted in this work.

While the book lacks the emotionalism that characterized Helen Hunt Jackson's *A Century of Dishonor*, it tells the same story, and one may hope it will be as widely read. In view of the revelations made by the recent investigation of the Navajo Indians in Arizona, made jointly by the Indian Rights Association and the Phelps-Stokes Foundation, this book dealing with the Oklahoma Indians is very timely.

THE PUEBLO INDIANS OF SAN ILDEFONSO: *A Changing Culture. Number 34 in the Columbia University Contributions to Anthropology.*

By William Whitman, 3rd. Columbia University Press, New York. $2.75. x + 164 pp. 1947.

San Ildefonso is a small Indian village (56 adults), located 22 miles northwest of Santa Fe, that has become more widely known in recent times for the pottery which its women produce for tourist consumption. In this monograph we encounter the familar Pueblo atmosphere of intensive religiousness, suppression of all overt aggression, and yet of factional strife and suspicion. The author was especially interested in child behavior. I have not the impression that he found anything particularly new or interesting for those beyond the circle of Pueblo specialists.

ERWIN H. ACKERKNECHT

THE INDIANS OF LOUISIANA. *University Social Studies Series.*

By Fred B. Kniffen, with illustrations by Mildred Compton. Bureau of Educational Materials, Statistics and Research, Louisiana State University and Agricultural and Mechanical College, Baton Rouge. 26 cents (paper). 110 pp.; ill. 1945.

This was written for use in the fifth grade. It is the result of the local demand for information on the Indians and on the history of Louisiana. The author is a long-time student of the Indians of that area, and he has managed to present in most readable form a concise picture of the origins of the American Indians, the coming of the Indians to Louisiana, the sequence of cultures to be found, together with a picture of the everyday life in an Indian village. It is an excellent and authoritative job. It is also lavishly illustrated with black and white drawings of blow guns, Indian designs, villages, etc. This visual aid for the comprehension of such difficult items as the spear-thrower is a valuable feature. There is appended a group of Indian myths and stories.

GEORGE F. CARTER

CHANGING KINSHIP SYSTEMS: *A Study in the Acculturation of the Creeks, Cherokee, and Choctaw. Anthropological Series, Field Museum of Natural History, Volume 33, Number 4. Publication 583.*

By Alexander Spoehr. Field Museum of Natural History, Chicago. $1.00 (paper). Pp. 151–235; ill. 1947.

The author is able to show that the Creek, Cherokee, and Choctaw Indian tribes of the Southeastern United States had a kinship system of the Crow type, at the time when, about a hundred years ago, they were deported ("they moved," the author says euphemistically) to Oklahoma. Kinship systems changed increasingly from the old lineage to the contemporary generation pattern. These changes reflect a deep transformation of the social structure. The traditional family, built around matrilineal lineage, the clans, and the townships are all gone. The modern community is a church community. Intermarriage with whites and political and economic pressure of the latter have produced this situation.

Starting very competently in a sphere which is accessible only to specialists, the author discusses problems of increasing common interest and validity and ends his excellent study with some thought-provoking tentative generalizations.

ERWIN H. ACKERKNECHT

PAPAGO INDIAN RELIGION. *Columbia University Contributions to Anthropology, Number 33.*

By Ruth M. Underhill. Columbia University Press, New York. $4.50. viii + 359 pp. 1946.

Ruth Underhill here continues her series of studies on the Papago. Like her other books, this one is written in easy and interesting prose. It makes fascinating reading for insight into a primitive people's religion and literature. The author has a most happy faculty of catching a people's mode of expression and converting it into English so that little of its strength and character is lost.

The material is presented under the principal headings of Communal Ceremonies, Ceremonies for Individual Power, The Use of Power, and Acculturation. Each topic is presented in terms of Papago life and is discussed in relation to the rest of the Southwest. The speeches, songs, and recitations are given in full and usually in numerous versions. There is an appendix discussing the prayer-stick festival. This ritual is of especial significance, as it seems in many of its elements to be Puebloan and non-Papago. Ruth Underhill also calls attention to the significance of the Papago creation myth, where there are sharp breaks involving the coming of alien people, together with the description of the destruction of the Great Houses (of which Casa Grande National Monument is the only survivor.) This is, then, not only a book on Papago religion. It is also a collection of primitive literature, and a valuable source book for any student of the Southwest.

GEORGE F. CARTER

THE AMERICAN INDIAN IN NORTH CAROLINA. *Duke University Publications.*

By Douglas L. Rights. Duke University Press, Durham, North Carolina. $5.00. xx + 296 pp. + 111 plates + 1 map. 1947.

The author is an intelligent amateur who has for years collected material about the Indians in North Carolina. The limitation of subject is rather artificial, and the tone of the work is provincial. The bulk of the material is a "rewrite" of historical material, with copious reprinting of interesting sections. Many of the 17th century paintings of the Indians of the region, by John White, have been used for illustrations. Their reprinting is a contribution.

Books such as this are a puzzle. If one is really interested in the American Indian, he would do better to turn to original sources; if one is looking for interesting reading, he will still find better in the original sources.

GEORGE F. CARTER

A NAVAHO AUTOBIOGRAPHY. *Viking Fund Publications in Anthropology, Number Eight.*

By Walter Dyk. The Viking Fund, New York. $3.00 (paper). 218 pp. + 16 plates. 1947.

This is the life story of an Old Mexican, told in his own words, and presented in chronological order, with a minimum of editing. It is fascinating reading. Anyone can read this with all the pleasure of another autobiography or, for that matter, of a good novel. It is replete with all that goes to make a good story. Humor, murder, sex, and pathos fill its pages.

But its value is far greater than its colorful and amusing qualities. It is a storehouse of information on the changing ways of life of the Navaho in the period of stress occasioned by their coming under the domination of the white man. Specialists of all sorts will mine this work for information in all lines: sex life, agriculture, food consumption, working conditions, infant mortality, primitive disease treatment, impact of diseases on a non-immune society (e.g., mumps apparently caused death within 24 hours, in some cases).

The author has annotated the work rather fully. His contribution, in addition to gathering the story and editing it, consists of these foot notes. In these he calls attention to attitudes and often gives the background and cultural motivation and setting of many of the acts of the principal character.

GEORGE F. CARTER

BIOMETRY

MATHEMATICAL METHODS OF STATISTICS. *Princeton Mathematical Series.*

By Harold Cramér. Princeton University Press, Princeton. $6.00. xvi + 575 pp. 1946.

During the last 25 years British and American statisticians have been developing and amplifying the methods and techniques of statistical inference. During the same period, French and Russian mathematicians have transformed the classical calculus of probability into a rigorous and pure mathematical theory. The purpose of Cramér's book is to join these two lines of development in a presentation of the mathematical theory of modern statistical methods in so far as they are based on the concept of probability.

This is a highly technical book—one certain to have an extremely limited audience among biologists generally. It requires of its reader a fairly advanced knowledge of pure mathematics. The treatment of the material is so theoretical that the practical statistician will find little here to help him in his everyday work. But the advanced statistician who is interested in the proofs, derivations, and esoteric interrelations between many of the new sampling statistics—Fisher's t, the z transformation for correlation coefficients, χ^2, etc.—and their sampling distributions, should find this an invaluable handbook and reference.

A. CHAPANIS

PROBIT ANALYSIS: *A Statistical Treatment of the Sigmoid Response Curve.*

By D. J. Finney, with a foreword by F. Tattersfield. Cambridge, at the University Press; The Macmillan Company, New York. $3.75. xiv + 256 pp. 1947.

This is a textbook on the subject of biological assay as used in assessing the potency of drugs, insecticides, etc. It concerns itself almost exclusively with the case where the assay is dependent upon an all-or-nothing response. The methods of analysis developed largely by Gaddum and Bliss are considered in detail and presented in systematic form.

The book begins with certain general considerations in assay analysis. This is followed by the conventional method of probit analysis, in which the response curve is transformed into a straight line, which is then fitted free-hand or by the method of least squares. Methods for comparing the effectiveness of different preparations are adequately discussed. The author also includes a brief treatment of other methods of analyzing the assay, but does not mention the inverse sine transformation. The latter half of the book is devoted to various refinements and extensions, covering such subjects as the joint effects of two factors, mixtures of drugs, factorial experiments, etc. There is also a brief chapter on assays in which the response is graded rather than quantal.

The book concludes with a very complete bibliography of over 100 titles and a set of seven tables necessary to probit analysis, such as a table of transformations, one of weighting coefficients, one of chi-square, etc.

While this book will not be easy reading for research workers generally, it should offer no difficulty for those with some knowledge of elementary statistical procedures. There is much in it, including an appendix on the theoretical basis of the method, that will be of interest to the mathematical statistician. The book is a very valuable tool for anyone connected with assay techniques.

JOHN W. FERTIG

TABLES PREPARED BY THE MATHEMATICAL TABLES PROJECT, *National Bureau of Standards.*

The three volumes reviewed below are the latest in the excellent series of tables begun under the Mathematical Tables Project of the Works Progress Administration for the City of New York, under the sponsorship of the National Bureau of Standards. With the discontinuance of the Works Progress Administration, the sponsoring agency took over the project, under the auspices of the Applied Mathematics Panel of the National Defense Research Committee. Emphasis was placed on tables related to the war effort, with attention also devoted to the completion of tables that had been started under the former auspices. The first two volumes reviewed are in the latter class. They were started under the Works Progress Administration, continued under the regime of the Applied Mathematics Panel, and brought to completion under the auspices of the Navy Department.

The entire project has had the cooperation of leading scientists, and the tables produced form a very valuable addition to our scientific equipment.

TABLES OF SPHERICAL BESSEL FUNCTIONS. *Volume I. Prepared by the Mathematical Tables Project, National Bureau of Standards. Columbia University Press, New York.* $7.50. xxviii + 375 pp. 1947.

TABLES OF SPHERICAL BESSEL FUNCTIONS. *Volume II. Prepared by the Mathematical Tables Project, National Bureau of Standards. Columbia University Press, New York.* $7.50. xx + 328 pp. 1947.

The functions $\sqrt{\pi/2x}\, J_{n+\frac{1}{2}}(x)$, known as spherical Bessel functions or Stokes functions, are tabulated. The main table in Volume I contains the functions of order $\pm (n + \frac{1}{2})$, where n has all integral values from 0 to 13, and x has values from 0 to 10 at intervals of .01, and 10 to 25 at intervals of .1. The corresponding table in Volume II contains the functions of order $\pm (n + \frac{1}{2})$ for n taking the integral values 14 to 30, and x the same values as in Volume I. Supplementary tables provide values to facilitate interpolation.

An introduction explains the nature of the functions and a foreword discusses their application. The applications at the present time are principally in the field of wave mechanics, which includes an ever-increasing variety of problems. These include the analysis of atomic and molecular structure, the theory of nuclear disintegration, electrical oscillations in a high frequency radio tube, the diffusion of light beams, and many other phenomena. The recent developments in this field make the appearance of these tables very timely.

TABLE OF THE BESSEL FUNCTIONS $J_0(z)$ AND $J_1(z)$. *Second Edition.*

Prepared by the Mathematical Tables Project, National Bureau of Standards. Columbia University Press, New York. $7.50. xliv + 403 pp. 1947.

This is the second edition of this volume, first published in 1943. (Reviewed Q.R.B. 19, 364. 1944.) No errors have been reported in the tables since the appearance of the first edition, and the tabular material has been reproduced from the same negatives used originally. Certain errors have been noted in the labelling of some of the graphs, and these have been corrected in the present edition. There has also been some revision in the Introduction.

The appearance of the second edition in such a short time indicates the need filled by this table.

MARGARET MERRELL

DE OMNIBUS REBUS ET QUIBUSDEM ALIIS

KUNGL. FYSIOGRAFISKA SÄLLSKAPETS I LUND FÖRHANDLINGAR. *Proceedings of the Royal Physiographic Society at Lund, 1946. Band 16.*

Gleerupska Univ.-Bokhandeln, Lund. 9 kr. (paper). 55 + 252 pp. + 3 plates; text ill. 1947.

This volume contains the following papers of a biological nature: Über die Sporenkeimung bei *Bangia* und *Porphyra* (H. Kylin); The influence of some cations on *Ulva lactuca*, and a note on its nitrogen sources (A. Kylin); On the epifauna of an anti-submarine net in the northern part of the Sound (H. Brattström); Some culture experiments with *Ulva* and artificial sea water (T. Levring); Über die Entstehung der Ruckendrüse bei *Procavia* (I. Broman); Anzahl Zellen per Raumeinheit (G. Backman); Anzahl der Beerdigten aus der Discrepanz gefundener rechts- und linksseitigen Knochen berechnet (G. Backman); Einige bemerkenswerte Pilzformen aus den Kohlengruben Schonens (O. Gertz); Über den chemischen Aufbau der Zellwände bei *Ulva* und *Enteromorpha* (H. Kylin); Über die Natur der Peroxydasereaktion der Algen (S. Rönnerstrand); Kleinere Notizen über freilebenden Nematoden (C. A. Allgén); Colombianische Blattodeen, gesammelt von Herrn G. Dahl und Frau Althén-Dahl in den Jahren 1936–1939 (K. Princis); Drei neue neotropische Blattodeen (K. Princis); Die Verbreitung der Amphibien und Reptilien in Estland (H. Kauri); Observations on the development of *Erysiphe graminis* DC. (K. Björling); Preliminary report on certain Swedish freshwater Oligochaeta (T. Almstedt); A note on the type of *Rana arvalis* Sv. Nilss. (T. Gislén); Studier över könskvoten hos vattenödlor (O. Persson; Eng. summary); Über den Zuwachs der Keimlinge von *Ulva lactuca* in verschiedenen Nährflussigheiten (H. Kylin).

SCIENCE EXPERIENCES WITH HOME EQUIPMENT. *By Carleton John Lynde. International Textbook Company, Scranton.* $1.60. xiv + 226 pp.; ill. 1937.

This is not a new book, nor are the experiments it contains biological, except for one section on body balance and reflexes; but the very simple experiments on physical properties that are outlined indicate a direction in which laboratory planning for children should go. Anyone who has the task of preparing a laboratory manual will find fruitful suggestions here.

ORIGIN AND DEVELOPMENT OF CRATERS. *The Geological Society of America Memoir 21.*

By T. A. Jaggar. The Geological Society of America, New York. $6.00. xviii + 508 pp. + 87 plates; text ill. 1947.

In this volume the author records the results of 25 years of study of Hawaiian volcanos. Most of this material is highly technical and will thus be of interest only to those specializing in volcanology and related subjects. Of perhaps more general interest are the numerous excellent photographs which illustrate various phases of volcanic activity.

THOMAS W. AMSDEN

CONVECTION PATTERNS IN THE ATMOSPHERE AND OCEAN. *Annals of the New York Academy of Sciences, Volume XLVIII, Article 8.*

By R. B. Montgomery, John C. Armstrong, Horace R. Byers, Phil E. Church, Richard A. Craig, B. Haurwitz, Walter H. Munk, Henry Stommel, Harry Wexler, Raymond Wexler, A. H. Woodcock, and Jeffries Wyman. New York Academy of Sciences, New York. $2.00 (paper). Pp. 705–844 + 15 plates. 1947.

POLYELECTRONS. *Annals of The New York Academy of Sciences. Volume XLVIII, Article 3.*

By John Archibald Wheeler. The New York Academy of Sciences, New York. 75 cents (paper). Pp. 219–238. 1946.

THE LIMITATIONS OF OPTICAL IMAGE FORMATION. *Annals of the New York Academy of Sciences, Volume XLVIII, Article 1.*

By Max Herzberger. New York Academy of Sciences, New York. 75 cents (paper). Pp. 1–30. 1946.